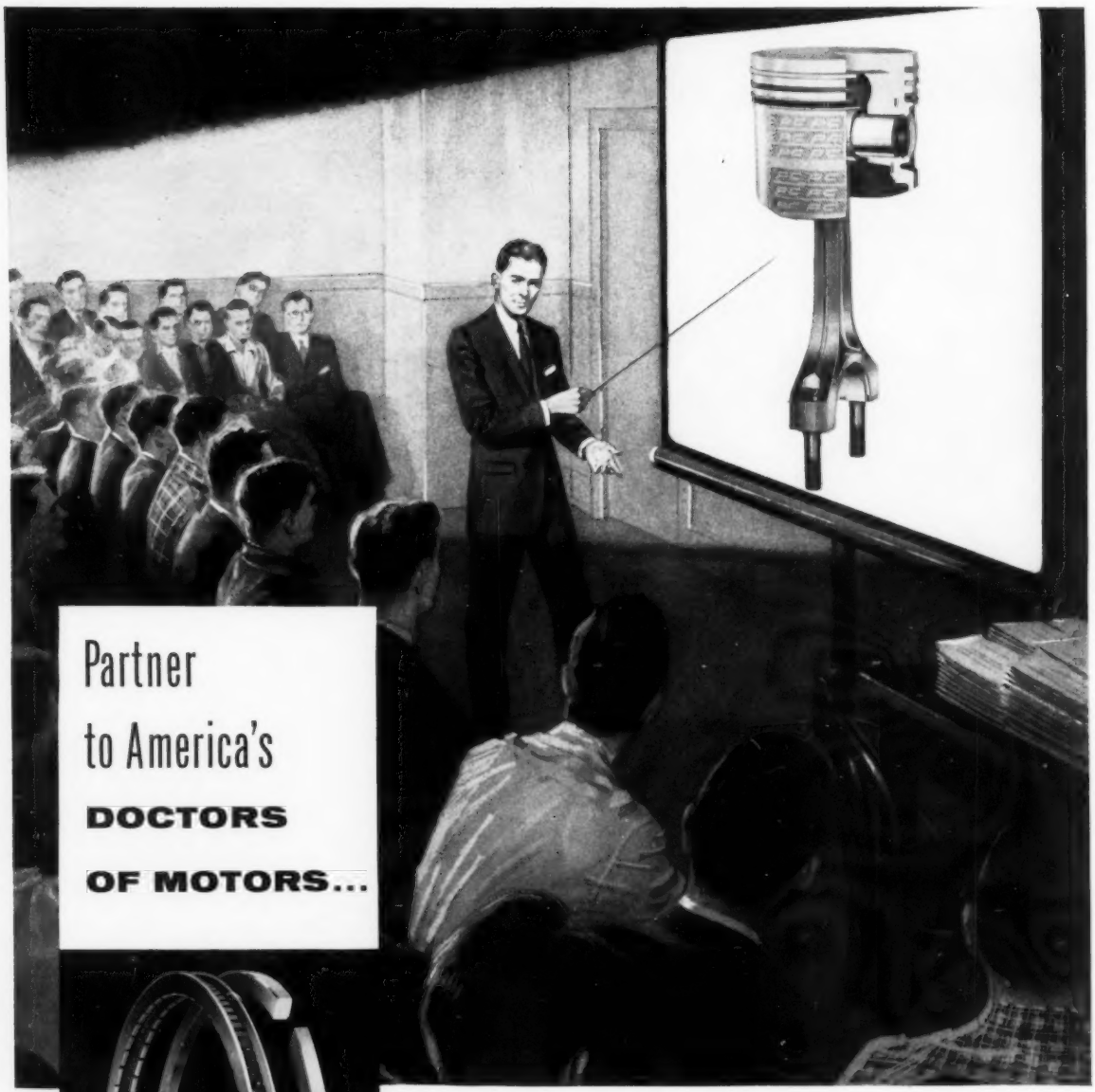
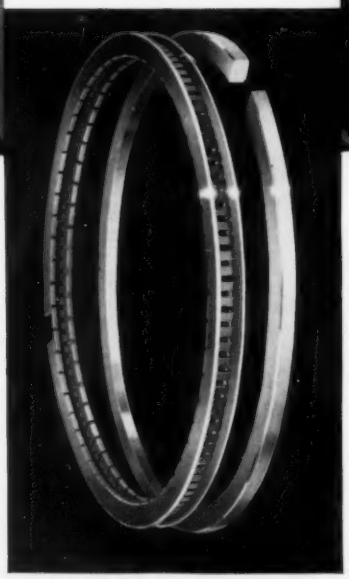
Automotive Service Digest

Our 46th year March, 1958

Time to De-Winterize!—See Page 12.



Partner to America's **DOCTORS OF MOTORS...**



For many, many years, Perfect Circle has been a champion of the thousands of skilled mechanics who keep America on wheels.

In promoting this public recognition of the importance of the skilled mechanic, Perfect Circle also recognizes a responsibility. This is the responsibility of helping mechanics keep up with the constant improvements being made in the modern automotive engine. To this end, Perfect Circle joins PC distributors in conducting Doctor of Motors Clinics like the one pictured above.

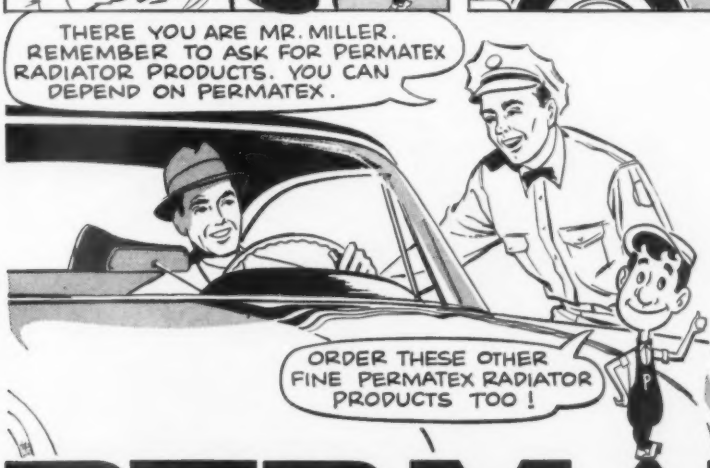
The tens of thousands of mechanics who attend these sessions receive valuable technical information, and upon passing a written examination are awarded Certificates attesting their qualifications as Doctors of Motors. Plan to attend the next Doctor of Motors Clinic in your area! Perfect Circle Corporation, Hagerstown, Indiana; The Perfect Circle Co., Ltd., 888 Don Mills Road, Don Mills, Ont.

Since 1903... partner in progress to the automotive industry

PERFECT CIRCLE PISTON RINGS

PERMATEX PETE AND HEAVY DUTY RADIATOR CLEANER SAVE THE DAY!

BETTER CLEAN OUT THAT RADIATOR MR. MILLER, BEFORE IT GUMS UP THE WHOLE COOLING SYSTEM.
PERMATEX HEAVY DUTY RADIATOR CLEANER WILL DISSOLVE ALL THAT RUST AND SLUDGE... FASTER TOO!
REMEMBER MECHANICS, NOW PERMATEX RADIATOR PRODUCTS COST YOU LESS!
IS THAT GOING TO TAKE ALL DAY?
NO SIR! I'VE FINISHED WITH THE CLEANER. NOW I'M PUTTING IN PERMATEX WATER PUMP LUBRICANT AND RADIATOR ANTI-RUST.


THERE YOU ARE MR. MILLER. REMEMBER TO ASK FOR PERMATEX RADIATOR PRODUCTS. YOU CAN DEPEND ON PERMATEX.
ORDER THESE OTHER FINE PERMATEX RADIATOR PRODUCTS TOO!

Block & Head Sealer
Double Action Radiator Cement
Cooling System Cleaner & Conditioner
Radiator Sealer (Liquid)
Indian Head Radiator Cement

PERMATEX

PERMATEX

COMPANY, INCORPORATED

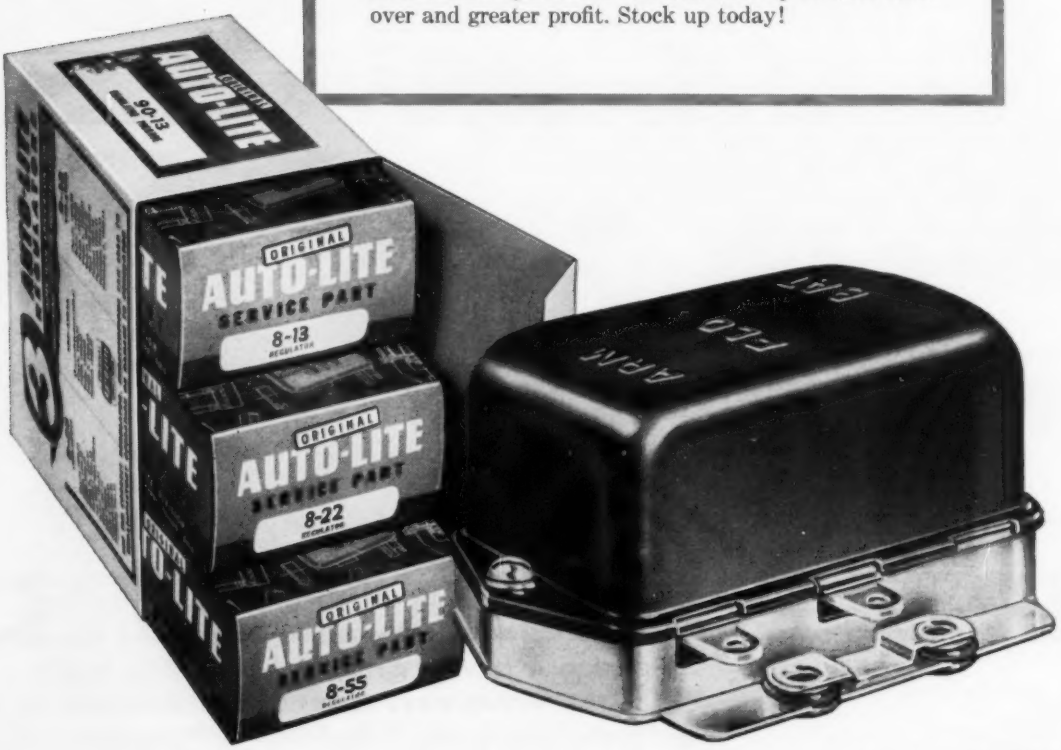
300 Broadway, Huntington Station, N.Y.

Factories: Brooklyn 35, N. Y., Kansas City 15, Kan.

AUTO-LITE®
VOLTAGE REGULATORS

Now combined in one handy package are two 6-volt and one 12-volt Auto-Lite Voltage Regulators that give you coverage of most 6- and 12-volt Auto-Lite equipped vehicles produced from 1940 through 1957. Application information is on the side of the 3-unit package.

This new 6- and 12-volt Auto-Lite Regulator Package (90-13) saves you valuable shelf space, simplifies inventory checking. Wider coverage with a smaller inventory investment is yours. All of which adds up to more turnover and greater profit. Stock up today!



Easier to stock...

Auto-Lite Original Service Parts are engineered to cover the widest number of applications. This means you save money because you operate with a small stock and a lower inventory investment. You also save time because the new simplified numbering system makes Auto-Lite parts easy to order and maintain inventory.

Easier to use...

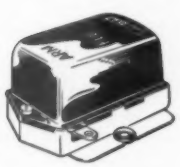
There's never any doubt about Auto-Lite Original Service Parts being right. They are made by the manufacturer of the original part and made exactly the same as the original part. Exhaustive laboratory and field tests insure original quality.

Easier to sell...

Years of Auto-Lite advertising and promotion have helped pre-sell your customers on Auto-Lite Original Service Parts. The name "Auto-Lite" is quickly recognized and respected. To help you further, a coast-to-coast network of Auto-Lite Field Training Schools is available to train your men.

Ask about the Auto-Lite Original Service Parts cabinet program that includes this cabinet. It's 24" wide, 12" deep and 42½" high. Comes complete with Auto-Lite Parts Catalog and Cross Reference Book, AEA Fast-Moving-Parts Book, Price Book. Program places you on mailing list for latest technical and service information.

ORIGINAL
AUTO-LITE
SERVICE PARTS



VOLTAGE REGULATORS

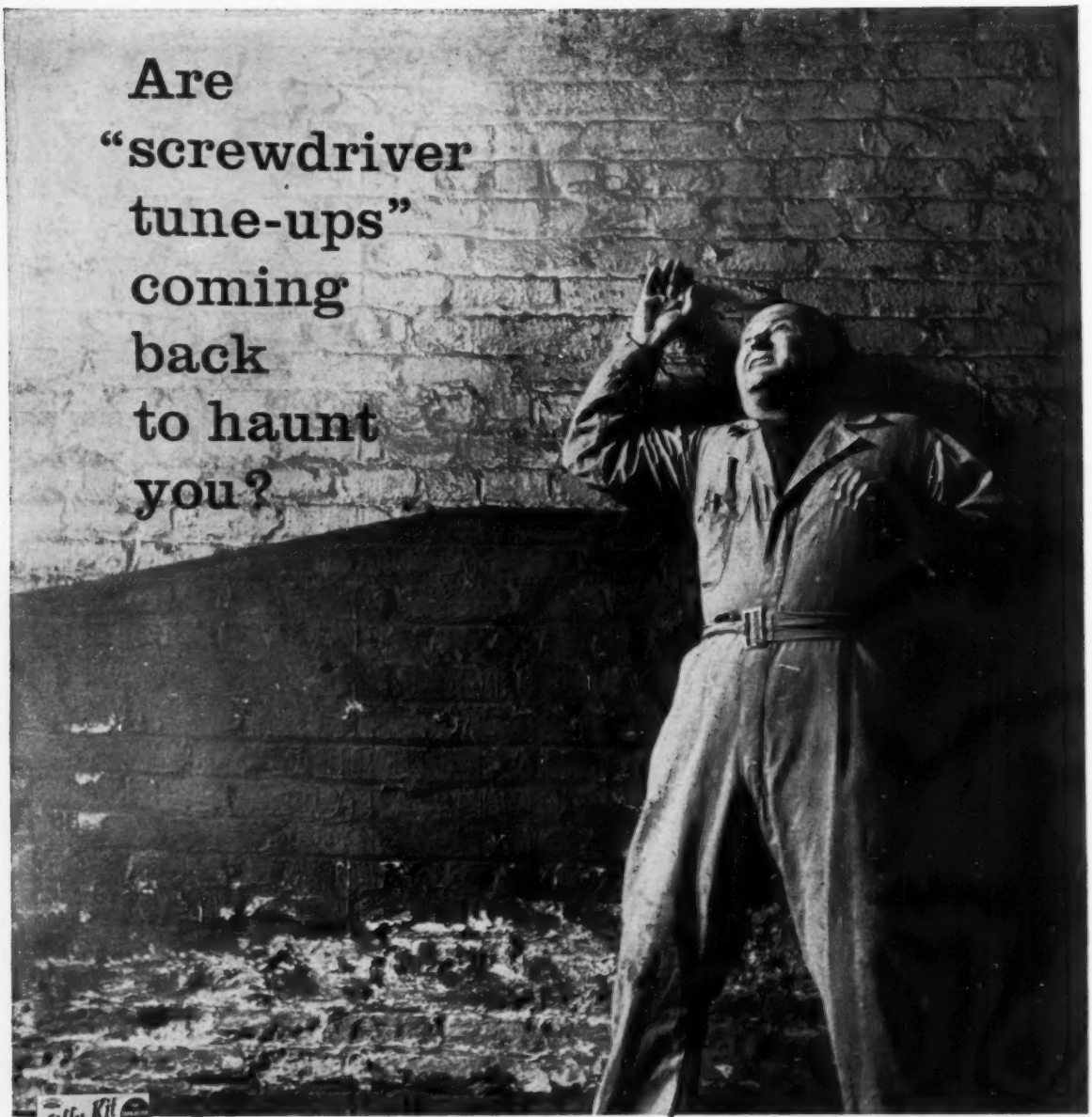
COILS

CONTACT SETS

DISTRIBUTOR CAPS

CONDENSERS

THE ELECTRIC AUTO-LITE COMPANY, TOLEDO 1, OHIO



HANDY
JIFFY-RAK
FREE
ASK YOUR
JOBBER

Tune up carburetors fast (and protect your reputation) with

HYGRADE JIFFY KITS

Just the parts you need for a fast, safe carburetor tune-up. Pump piston plungers, needles and seats, gaskets, instructions and even necessary gauges in every JIFFY KIT. Coverage for all popular cars. See your Hygrade jobber or write HYGRADE PRODUCTS DIVISION, Standard Motor Products, Inc., 37-18 Northern Blvd., Long Island City 1, N. Y.

HYGRADE AUTOMOTIVE PRODUCTS

CARBURETOR PARTS • FUEL PUMPS & PARTS
SPEEDOMETER CABLES & CASINGS

VOLUME XXXXVI
No. 554

Oscar H. Baehler, Publisher
Ben M. Ikert, Editor
G. A. Whittington, Managing Editor
Herb Carrier, Detroit Editor
Guy F. Wetzel, Technical Editor
Ed Packer, Feature Editor
E. S. Harris, Field Editor
Gerry Dawson, Assistant Editor
Leslie L. Flood, Art Director

MEMBER ABC ABP

Published and printed monthly at Chicago, Ill., by Automotive Service Digest, a division of National Market Reports, Inc., 900 So. Wabash Ave., Chicago 5, Ill.

W. Earl Butler, president
Chas. E. Gambill, vice pres. & treasr.
O. H. Baehler, vice pres. & genl. mgr.
H. G. Hollingshead, secretary

Subscriptions: $4.00 for 1 year, $6.00 for 2 years, U.S. Possessions and Canada. Single copies 40c. Back copies 75c ea. Foreign subscriptions $5.00 per year. Second class mail privileges authorized at Chicago, Ill. Copyright 1958 by National Market Reports, Inc.

Charles W. Taylor, circulation manager

BRANCH
ADVERTISING OFFICES

New York 36, N. Y.
Gordon C. Marsters
33 W. 42nd St.
OXford 5-6068

Chicago 5, Ill.
O. T. Butcher
900 S. Wabash Ave.
HArrison 7-3464

Detroit 2, Mich.
Frank Heib
914 Stephenson Bldg.
Cass and Grand Blvd.
TRinity 3-4840

Cleveland 15, Ohio
310 Caxton Building
812 Huron Road
PRospect 1-2872

OTHER
ADVERTISING REPRESENTATIVES

Los Angeles 57, California
The Maurice A. Kimball Co., Inc.
2550 Beverly Blvd.—DUnkirk 8-6178

San Francisco, California
The Maurice A. Kimball Co., Inc.
681 Market St.—EXbrook 2-3365

Kansas City, Missouri
C. H. Stockwell Co.
4117 West 67th St.—COlfax 2-5131

Minnesota-Wisconsin
Badger & Flanagan
35 E. Wacker Drive, Chicago, Ill.
ANdover 3-5399

Automotive Service Digest

March 1958

Cover

Boreas' icy blasts will soon give way to balmy breezes, your cue that customers' cars are about due for "summerizing" and pre-vacation service work.

Articles

12 It's time to de-winterize
14 The stickin'est valve
16 Which way suspension?
22 Road testing inside the shop
28 Engines must breathe clean air
31 Record Pacific Automotive Show
34 Does it pay to farm jobs out?
38 Trouble shooting the charging system
52 Servicing the Fordomatic
58 Universal joint service
78 Annual editorial index

SYMBOLIZES A.S.D.
"TECH KNOW-HOW"
FEATURE ARTICLES

Features

6 Automotive clinic
11 The Editor's page
62 New products
70 Tax guide and business briefs
75 Calendar of automotive events
77 Refresher course
78 Annual Editorial index

For April

● Grease and oil team up with motor vehicles just like ham and eggs pair up. But grease and oil have to be kept in and dirt must be kept out. That's where seals come in. Greasy front wheel white walls and greasy brake linings, for example, are mute evidence that service work is needed. We're telling you about seals, what kind to use where, how to install them, etc.

● Somebody's always coming up with new approaches and wrinkles on tune-up jobs. Since April is the month when engines, especially those that had a lot of tough cold weather operation, should be brought up to par, we have put together an article on tune-up with a new approach. We're sure you'll like it.

● How about the automatic transmission series currently running? Like it? Coming along in April you will get the story behind the PowerFlite from our Detroit Editor, Herb Carrier. Have had an immense amount of good comment on this series, which at its completion will have taken in all the automatics.

Automotive clinic

Stuck on some problem? Need help on a job? Write us about your problem on your shop letterhead and the information you are looking for will be promptly sent you.

Address your letter to Automotive Clinic c/o AUTOMOTIVE SERVICE DIGEST, 900 S. Wabash Ave., Chicago 5, Ill.

Ben Ikert, Editor

Measuring Vacuum

When doing carburetor work, what is meant by 20" Hg manifold vacuum, for example?—*J.M., Staten Island, N.Y.*

Answer: Vacuum in the intake manifold, or other place around the engine is measured in inches of mercury, the same as the barometer uses inches of mercury to measure the pressure of the atmosphere.

The chemical symbol of mercury is Hg, and is used because it is shorter and easier to write than the word "mercury." For example, we might say that the manifold vacuum at idle is 20" Hg, meaning 20 inches of mercury.

A perfect vacuum would be the same as the standard atmospheric pressure which is 29.92" Hg or roughly 30" Hg. Therefore, a vacuum of 20" Hg would be about 2/3 of a perfect vacuum.

Timing Is Erratic

We overhauled our 1949 Chevrolet pick-up truck—put in new rings, valves, wrist pins, etc., and the engine runs fine. But when we run the truck around 60 m.p.h., the timing goes off. The engine starts to ping when it slows down, and after re-timing it and driving the truck fast and then decelerating, the same thing happens. The distributor is good and tight, and all connections are okeh.—*L.M., Tucson, Arizona.*

Answer: It appears as if the distributor advance mechanism sticks and does not retard the spark in accordance with driving conditions, as it should.

Put the distributor on a distributor tester so you can see just what it does at various speeds, and check the action of the vacuum advance and the automatic advance. If the distributor is set to follow the factory specifications at each speed, and the advance devices are working correctly you will not have this trouble any more.

"Freeze Plugs"

A question has come up in our shop that we would like your opinion on.

It seems that many mechanics refer to "freeze out plugs" as such, claiming that they will pop out when a block freezes, thus protecting the block from cracking. A few feel that the plugs should be referred to as "welsh or core plugs" and are used simply to plug up holes in the block as a result of casting same. In addition they are used for cleaning the block. Would you please put us straight on this matter?—*L.R., Bronx, N. Y.*

Answer: The so-called "freeze plugs" are used primarily for closing up the necessary holes that have to be left in engine block castings to clean out the core sand of which the cores are made. These cores are needed to make the hollow spaces in the casting which becomes the water jacket, and the only way the core sand can be eliminated after the casting is made is through these holes.

The welsh core hole plugs are an easy way to plug up the holes, and at the same time provide a means of access to the water jacket space if the need for cleaning out accumulated rust, mud and scale arises. In only very few cases will the plugs pop out in case the liquid in the water jacket freezes, as the block will usually crack first.

"Pops" on Acceleration

Just happened to be reading one of the clinic items in one of your recent issues and I would like to pass on some information to R. B., New Paltz, N.Y., which I am sure is the answer to his problem of the engine popping back through the carburetor, especially on pulls at open throttle.

I am a mechanic for Days Transfer Truck Line, which has a sizeable fleet of Chevys and we have at times experienced the same conditions. We found the trouble was caused by weak intake valve springs. I thought you might like to pass on this information as it's a comparatively small job to change the valve springs. I am sure he will find it helpful.—*G.P., Wakarnsa, Ind.*

Editor's Note: Thanks, G P., for taking the time and trouble to send your experiences to us. Getting on-the-firing-line information from men like yourself, which we can pass on to ASD readers is making the clinic constantly more helpful.

Breaker Points Burn

Enclosed is a set of ignition points that ran only 2,900 miles before turning blue on the moving arm side. At about 4,000 miles the blue points will stop the car on the street. They are out of a 1954 Chevrolet Corvette, and this condition has existed since the car was new.

In an effort to correct this condition, I have changed the coil and condenser several times, grounded the distributor with another wire, checked all circuits for resistance and adjusted the voltage regulator to a maximum of 30 amperes and 7 volts. A new battery did not help either.

The points are always installed in alignment, spring tension carefully checked, and gap and dwell is properly adjusted. The only thing that has not been changed is the distributor, but the cam is in good shape, and the bushings fit well.—*D.G., Gilette, Wyoming.*

Answer: The points you sent us clearly indicate excessive current flow through them. One possibility is wrong polarity in the high tension system. Check this with a voltmeter or coil tester. With the *positive* terminal of the meter grounded, touching the *negative* terminal to any spark plug, with the engine running, should make the meter read up scale. If it does not, reverse the primary connections to the coil. You might also check the polarity of the battery as installed in the car, which should be negative ground. Polarize the generator by jumping momentarily from B

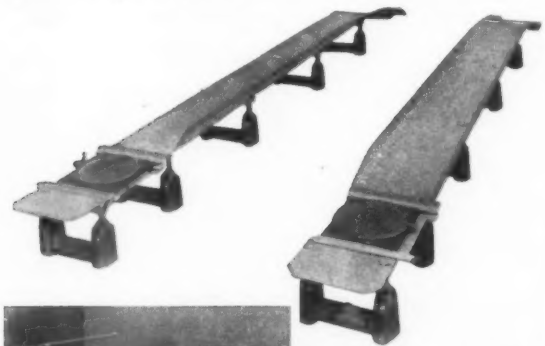
(*Continued on page* 72)

WHEEL ALIGNING NEWS

VISUALINER
John BEAN
STEERING SERVICE
The PRECISION of the STARS

Use These Versatile New Racks with 3 Types of Aligning Equipment

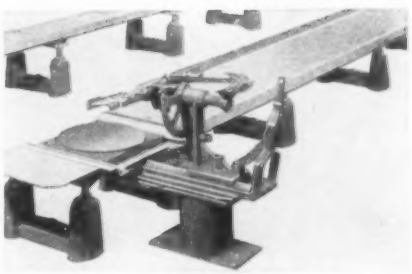
John Bean has announced a completely new series of aligning racks with versatility to fit a wide variety of needs at minimum cost. Two basic models are offered, one a short rack for pit use, the other a ramp type floor rack. Either is available for use with economical portable gauges, direct-reading mechanical gauges, or John Bean Visualiner optical heads.



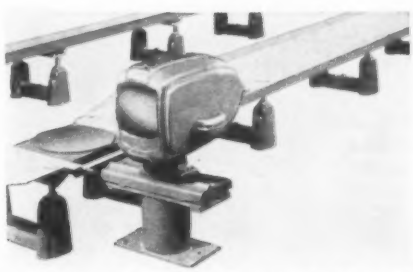
In addition to versatility and low cost, these new racks offer the same quality of construction typical in other John Bean aligning equipment. The floor type runways are each rigidly supported by five cast iron legs with levelling nuts that make installation easy on any uneven floor. Both types are 12 inches high for convenient under-the-car or over-the-fender work. Self-centering roller bearing turntables are standard equipment. Compact and solid, either rack fits easily into a single stall.

Combined With Portable Gauges New Racks Make an Economy Unit

These new John Bean aligning racks are available separately for use with your choice of low-cost portable gauges . . . an ideal way to open a new department at minimum cost. Later, whenever you choose, you can improve your service with the addition of mechanical gauges or Visualiner optical heads and background. For this purpose, John Bean offers both mechanical and Visualiner changeover kits that can be adapted easily and inexpensively to this new series of racks.



Use them with Mechanical Gauges



or Visualiner Optical Heads

For those who prefer the greater speed and accuracy of direct-reading mechanical gauges, John Bean offers a mechanical changeover unit, mounted on matching cast iron pedestals that are easily installed beside each runway. With John Bean mechanical gauges, all readings are accurately indicated on direct scales with the added advantage that a single unit checks caster, camber, toe in, toe out and king pin angle. It's so simple to use that any mechanic can make fast accurate checks after only a few minutes of instruction.

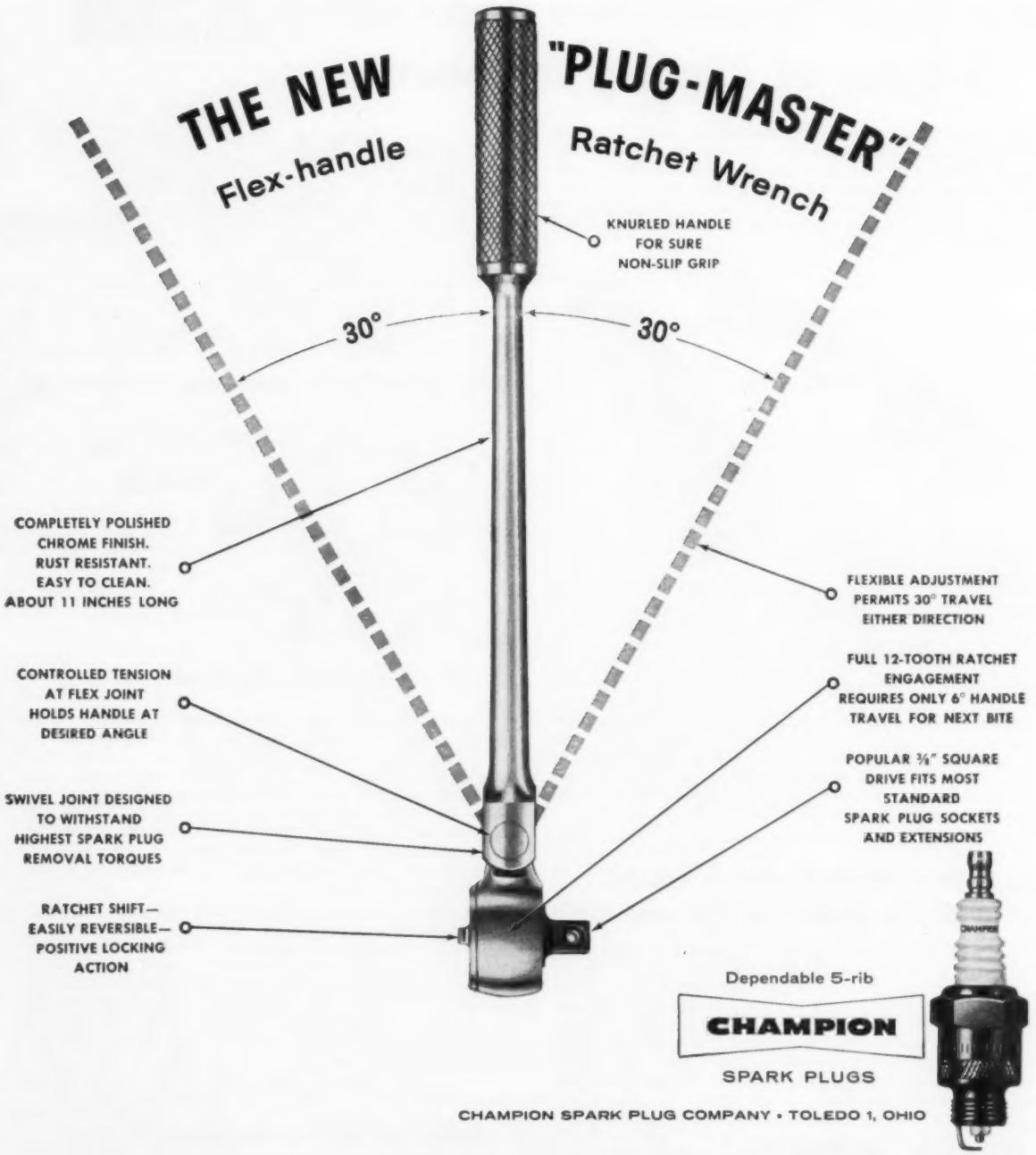
These same low-cost racks can also be used with the famous John Bean Visualiner. Mounted on pedestals the same as the mechanical units, the Visualiner changeover heads offer the ultimate in wheel aligning speed and precision. A background viewing screen is also furnished on which all readings are accurately projected. Manual checking is replaced by the fool-proof "eyes" of the Visualiner. Trial and error is eliminated because the projected readings show corrections as they are being made. With Visualiner you automatically know when perfect alignment is achieved . . . and so does your customer.

FOR MORE INFORMATION Write today for Bulletin L-1382

JOHN BEAN, Lansing 4, Michigan
Division of Food Machinery and Chemical Corporation

fmc

Champion Spark Plug Company to cut time and add profit


THE NEW
Flex-handle
"PLUG-MASTER"
Ratchet Wrench
KNURLED HANDLE FOR SURE NON-SLIP GRIP
30°
30°
COMPLETELY POLISHED CHROME FINISH. RUST RESISTANT. EASY TO CLEAN. ABOUT 11 INCHES LONG
FLEXIBLE ADJUSTMENT PERMITS 30° TRAVEL EITHER DIRECTION
CONTROLLED TENSION AT FLEX JOINT HOLDS HANDLE AT DESIRED ANGLE
FULL 12-TOOTH RATCHET ENGAGEMENT REQUIRES ONLY 6° HANDLE TRAVEL FOR NEXT BITE
POPULAR 3/8" SQUARE DRIVE FITS MOST STANDARD SPARK PLUG SOCKETS AND EXTENSIONS
SWIVEL JOINT DESIGNED TO WITHSTAND HIGHEST SPARK PLUG REMOVAL TORQUES
RATCHET SHIFT— EASILY REVERSIBLE— POSITIVE LOCKING ACTION
Dependable 5-rib
CHAMPION
SPARK PLUGS
CHAMPION SPARK PLUG COMPANY • TOLEDO 1, OHIO

Champions are engineered for every car built by Ford, General Motors, Chrysler,

designs new "Plug-Master" wrench on spark plug installations!

- *Developed by Champion Service Engineers, this new flex-handle ratchet wrench is adaptable to spark plug sockets and extensions now in use.*
- *Manufactured to Champion specifications by one of America's leading quality hand tool manufacturers.*
- *Available only in any one of four assortments of 50 fast-moving Champion plug types. Packaging in these assortments enables Champion to offer this new wrench at the low price of $4.25! (Spark plugs at regular 50-lot price.)*

As you know, one of the problems in servicing spark plugs is the fact that on many cars the plugs are "hidden" . . . buried under or behind generators, power steering units, heater ducts, etc. Often these items have to be completely removed before the spark plugs can be reached. This results in higher labor costs – and lower profits for you.

This new wrench holds down those labor costs – adds profit to your spark plug sales.

This new "Plug-Master" wrench is packed in with four different assortments. One is an assortment of popular Champion plug types for the over-all car market. The other three are specifically selected for Ford Motor Company, General Motors Corporation or Chrysler Corporation cars.

This wrench will give you a real competitive advantage, enabling you to handle spark plug installation jobs in less time . . . and with less trouble.

Available from your regular Champion supplier after March 15th.

These 4 assortments service 90% of the automotive market

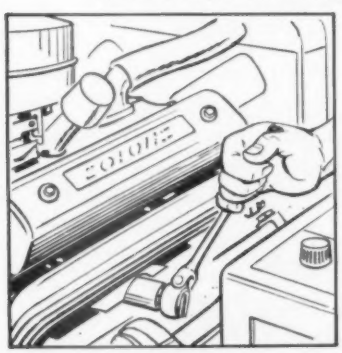
FOR MOST CARS
Popular types for the over-all car market. Contains 10 J-8, 10 H-10, 10 J-12Y, 10 J-18Y, and 10 F-14Y, plus "Plug-Master"

FOR FORD BUILT CARS
Contains 10 H-10, 10 870, 10 F-11Y, and 20 F-14Y, plus "Plug-Master"

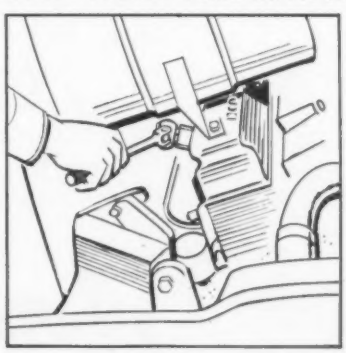
FOR GENERAL MOTORS CARS
Contains 10 J-8, 20 J-12Y, and 20 J-18Y, plus "Plug-Master"

FOR CHRYSLER CORPORATION CARS
Contains 10 XJ-8, 10 XN-12Y, 20 XJ-12Y, and 10 XJ-18Y, plus "Plug-Master"

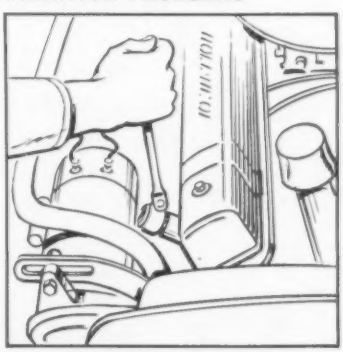
HERE'S HOW THE "PLUG-MASTER" SOLVES SOME DIFFICULT INSTALLATION PROBLEMS



For spark plugs located under exhaust manifolds



For spark plugs located under air cleaners



For spark plugs located next to generators, etc.

American Motors, Studebaker-Packard and every major foreign maker

Biggest Thing
IN HOSE CLAMPS

The greatest name in hose clamps is AERO-SEAL,
the FIRST and still the leader in precision worm gear clamps . . .
self-locking, tightest-sealing. Easy to install in seconds,
AERO-SEALS stay put – can't let go, snap open or jar loose.
Compare the STRENGTH of the worm gear. Note the band of 302-18-8 stainless steel.
Clamping is absolutely uniform all around the hose – equal pressure at every point.
AERO-SEALS won't pinch and damage hose. Re-usable over and over.
Wide range of sizes. Let the leader help you make money and satisfied customers.

For added quick-attach advantage:

Aero Seal QUICK ATTACH JET HOSE CLAMP

BREEZE MARK

Aero-Seal

REGULAR WORM GEAR HOSE CLAMPS

BREEZE CORPORATIONS INC., 700 LIBERTY AVENUE, UNION, NEW JERSEY

Editor's page

Safety service is a year 'round job

• ANY KIND OF SAFETY campaign conducted by certain segments of the industry during a specific month should be twelve times as good, theoretically at least, if plugged strongly the year 'round.

All have heard it said, "Wouldn't it be great if the Christmas spirit prevailed the whole year?" For a couple of weeks or so, people pick up the spirit—wrongs are righted, sins forgiven and it's great to enjoy the many festive occasions. Then, after a week or two, the spirit silently steals away and we're all back again in the proverbial groove of indifference. If every month could have some kind of Christmas atmosphere reminder, the cumulative impact over twelve months could be very productive.

And so with an automotive safety campaign. It does an immense amount of good at the time but at its conclusion the effect usually tapers off to await a shot in the arm at the next "annual" campaign. If safety, or any other worthy cause for better and safer operation of motor vehicles on the highways, is something to stress one week or one month of the year, what's wrong with putting on the pressure all the time? At least a little soft pressure to keep the campaign fluid.

We're reminded of the vital new program recently announced by GM to make America's highways safer after dark. It is, as it's sponsors say, a serious problem that confronts everyone. National safety and research organizations have reported the problem as centering in three vital and perhaps little-known facts:

1—In proportion to mileage driven, three times as many fatalities occur after dark as during daylight hours.

2—When headlight aim is too high, low or offside, up to 80 per cent of the light needed for safe driving vision is lost.

3—More than one-half of all cars on the road today have headlights which are *not* aimed accurately and safely.

Sponsoring a program such as this to bring about better and safer lighting is, of course, a most worthwhile undertaking in educating the public to the need for accurate headlight aiming.

But the program demands more. All of the educational effort to bring about correct aiming and sufficient candlepower will accomplish little good unless it is made easy for motorists to *get* efficient headlight service. Too, they must be reminded by the service man for the need of this service, because mighty few motorists are aware of how headlights get out of aim. The service shop or service station—wherever automotive service is sold—has a great new opportunity for offering a vital service to customers to increase their good will and the shop's income.

Let's check headlight aim as regularly as brakes, wheel alignment and tires, not only on safety programs, but all the time.

Ben Ikert
EDITOR

It's time to de-winterize

BY F. G. WELLS

HERE'S WHY COOLING SYSTEM CARE IS IMPORTANT!
Society of Automotive Engineers says: "Where anti-freeze has been used, drain the solution in the spring, flush the system thoroughly and clean if necessary, then install a fresh filling of summer rust inhibitor and water."
American Automotive Association says: "Motorists can avert many repair bills, often $75 or more for a new radiator, by checking the cooling system in their automobiles. Even the best anti-freeze should not be used a second season. Changing cooling solutions . . . makes the same good sense as changing motor oil."
National Bureau of Standards says: "In order to maintain maximum protection against corrosion, drain the anti-freeze solution after one winter's use . . . Under no circumstances should anti-freeze solution remain in the cooling system during the summer."

• **AFTER THE COLD,** freezing weather is definitely over, and anti-freeze protection is no longer needed, the question comes up as to what should be done to condition the cooling system for the warm or hot-weather driving facing the car owner. This question must be answered in one way or another—either leaving the anti-freeze in the cooling system, or draining it out.

If the volatile type of anti-freeze is used, there is no question about the need for draining it out. As for the so-called permanent type of anti-freeze, the various anti-freeze manufacturers recommend that it, too, be drained out after a winter's use. The corrosion inhibitor included in most permanent anti-freeze compounds is usually depleted after a winter season's operation, and with the inhibitor no longer active, rust is free to accumulate in the water jackets, and corrosion may attack the radiator tanks and/or core.

FUNCTION OF THE COOLING SYSTEM

The cooling system is designed to dissipate about 27% of the total heat released by combustion of the fuel in the engine. This is slightly more heat than is converted into work by the engine, and represents enough to keep a five-room house comfortable in zero weather.

In cold weather, the cooling system generally has an easy task, due to the fact that the temperature difference between the outside air and the coolant is from 100° to as much as 200°F. With a temperature difference that great, each pound of cold winter air will carry away and dissipate from 50% to 300% more heat than a pound of summer air. As a result, there can be adequate cold weather cooling with a system that is only one-fourth to one-half effective.

Therefore, a system that functions perfectly in winter, may overheat and boil in warm or hot summer weather. This would indicate that the spring change-over or check-up should definitely include attention to the radiator and the cooling system.

The heat dissipating capacity of the system must be sufficient to keep the engine at a safe operating temperature under all reasonable conditions of engine speed and load. Warm weather may require that every square inch of cooling system surface be used to hold engine temperature within safe operating limits.

Engines two years old or more frequently have rust, scale or mud in the cooling system, so that the tiny liquid passages in the radiator core are partially obstructed. This condition reduces the heat dissipating ability of the system. If the cooling system can't get rid of the heat as fast as it is generated in the engine, the temperature will climb. If the temperature gets up as high as the boiling point in a pressurized cooling system, the power plant is in trouble.

CHECKING FOR LIQUID LEAKAGE

Inspection for cooling system liquid losses is the most important operation in "de-winterizing" service, for when a vehicle is driven with insufficient coolant in the system, the engine can be quickly damaged by overheating. Contrary to general belief, evaporation of water or anti-freeze solutions accounts for only a small part of cooling system liquid losses. At least half of all liquid loss is due to leakage; most of the remaining half is through the radiator overflow pipe from boiling, foaming, etc.

To detect small leaks when they start, inspection should be made with the system cold. Small leaks, which may show dampness or even dripping when cold, can easily escape detection when the engine is hot, due to rapid evaporation. Certain parts of the cooling system are difficult to inspect for

leakage; for example, the rear of the engine jacket, some drain plug locations, the front side of the radiator on certain cars, some of the freeze plug locations, and the water pump seal.

Letting the car stand over night on a clean floor or on clean papers, will show the general location of leaks and help to spot them. The common points of leakage are the radiator, cylinder head gasket joint and studs, water pump shaft, hose connections, cracked engine castings, water jacket, freeze plugs, thermostat and pump housings, drain cocks and hot-water car heater.

While external leakage is a hazard, internal leakage if neglected, threatens not only the danger of overheating due to low liquid level, but also the possibility of admitting the coolant into the crankcase and moving parts of the engine—which may have even more serious consequences. This is particularly true in the case of permanent-type anti-freeze getting into the oil pan.

Both water and anti-freeze compounds are detrimental to lubrication, and either liquid mixed in sufficient quantity with engine oil forms sludge that can cause lubrication failure, sticky piston rings and valve stems, excessive wear and extensive engine damage if driving is continued. Permanent anti-freeze, in addition, may coat all internal parts with a sticky film, requiring the dismantling and cleaning of the entire engine.

DETECTING INTERNAL LEAKS

The common points of internal leakage are loose cylinder head gasket joints, loose cylinder studs or bolts, porosity or cracks in cylinder head or block. Checking for internal leakage is not as simple as inspection for external leaks. However, there are several tests that can detect internal leakage before it becomes too serious.

1. Start with the engine cold, first removing the fan belt from the pump pulley to prevent pump operation. Drain the system partially—until the liquid level is even with the top of the cylinder block, but no lower. Remove the upper radiator hose, the thermostat housing and thermostat. Replace the thermostat housing and fill with water.

With the transmission in "neutral," gun the engine several times, watching for bubbles in the water opening; also check as the engine drops back to idle. To detect smaller leaks, jack up the rear wheels and run the engine at 2000 rpm; load it for about five seconds at a time by applying the brake with the transmission in high or "Drive."

Bubbles or sudden rise of the liquid level indicate the leakage of gas into the cooling system. Injecting a light oil into the carburetor while making this test sometimes helps to identify exhaust gas leakage by introducing smoke into the bursting bubbles.

(*Continued on page 48*)

Explain to customers that the cooling system is one of the most important parts of the engine . . . and leaving winter-worn anti-freeze in the radiator all year round is an invitation for rust and scale deposits to reduce engine efficiency.

When you've drained the system, make sure it is clean, using a cooling system cleanser if necessary. Then refill with clean water fortified with a good brand of anti-rust.

(Illustrations, courtesy of the Olin Mathieson Chemical Corp.)

Here's an example of what happens if the cooling system is neglected. Rust and scale deposits build up which restrict circulation and reduce cooling efficiency. This can result in burned valves, cracked cylinder blocks, scored cylinders and improper lubrication.

By HERB CARRIER
Detroit Editor

You can now put away your witch's brew, because science appears to have come up with the answer to servicing . . .

The stickin'est valve

• WE THOUGHT poor old Ed had flipped his lid when he slipped a bottle from the "coke" machine, shook it violently and said, "This is the best stuff in the world for freeing up stuck valves."

Ed was an ace mechanic from the old school, but it sounded like maybe lately he'd been using his head for an impact tool. Who else besides a lunatic would use soda pop to free up a stuck valve?

It was only after Ed explained that he was talking about *heat control valves*, that we decided he really wasn't off his rocker. These valves, as every mechanic knows, have been hammered on, spit at, and cussed out for years. They're just plain ornery. Often they've been accused of sticking on purpose, and nothing—oil, kerosene, graphite, baking soda, or even Ed's soda pop—seems to do a satisfactory job of making them work properly for any length of time.

Now, however, new products such as *Mopar Manifold Heat Control Valve Solvent*, and *RSA Autocare and Penetrating Oil*, which have been recently made available, apparently have the answer to keeping heat control valves operating correctly, and freeing up valves that seem to be hopelessly stuck in one position.

CONTROLS ENGINE EFFICIENCY

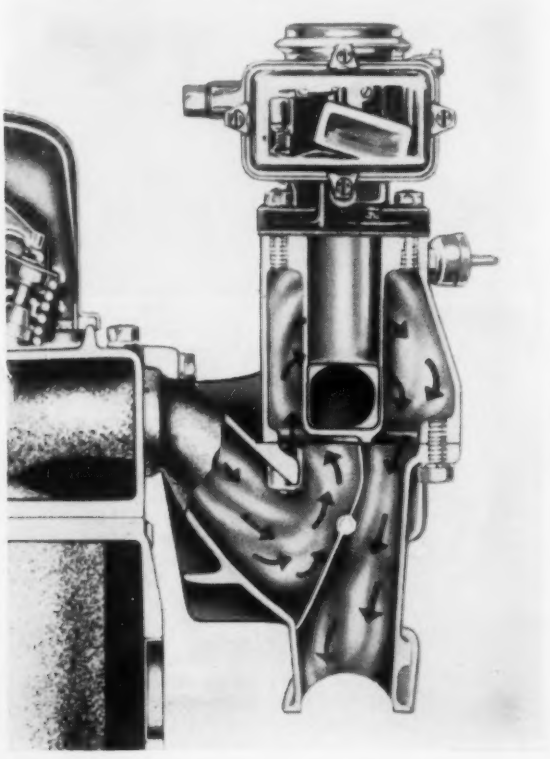
The heat control valve, more commonly called the "heat riser," serves a very vital part in overall engine performance. Basically, its function is to counteract several fundamental laws of nature.

For example, vapor will remain suspended in air as long as the air is warm. But if the air is suddenly cooled, the vapor condenses into large drops of liquid. This is what happens in the intake system of an engine.

Air, in passing through the carburetor, is mixed with fuel to form a vapor. The vapor consists of very fine particles of gasoline suspended in air.

However, as the fuel-air mixture passes through the carburetor venturi, and around the throttle valve, its pressure is lowered. Lowering pressure is a form of natural refrigeration, hence, the fuel-air temperature is quickly and greatly reduced.

This is why it's not uncommon to find frost around the carburetor and intake manifold of a racing engine, even on a hot summer day.



The "closed" heat riser acts as a gate valve and directs the flow of hot exhaust gases around the intake manifold. When the engine warms up, the valve "opens" and permits the gases to be discharged directly through the exhaust system.

EITHER FEAST OR FAMINE

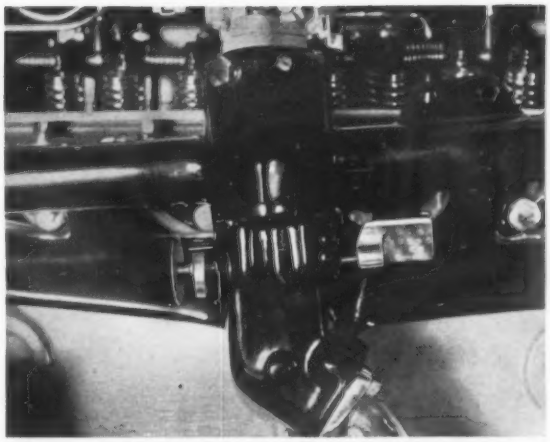
This chilling effect causes the vaporized fuel to condense into large, heavy droplets which quickly fall into the cylinders nearest the carburetor making these cylinders run "rich." Consequently, the cylinders furthest from the carburetor tend to run "lean," or are said to be "starved." A condition of some rich and some starved cylinders within one engine is called unequal fuel distribution, and, in a great many cases, poor distribution is the result of an inoperative heat riser.

Also, many other engine troubles can often be traced to an inoperative heat riser. Poor warm-up, carburetor icing, slow acceleration, and detonation, to name a few. Spark plugs, too, suffer when the heat riser doesn't do its job.

According to George M. Galster, Service Manager, Champion Spark Plug Co., "spark plug burning is often attributed to the valve being stuck in the 'heat on' position.

"And," said Mr. Galster, "we have had occasions where spark plug fouling has been due to a heat valve stuck in the 'heat off' position. Champion Spark Plug engineers have diagnosed many cases of engine malfunctions to a faulty heat riser."

As Mr. Galster points out, faulty heat risers can be the source of a whole lot of trouble . . . and it's not theoretical trouble . . . it's real. Reliable estimates say that four out of every seven cars now in use are delivering lowered efficiency because of malfunctioning heat risers.



A common mounting for a heat riser is directly below the carburetor. On six-cylinder engines it's not unusual to see the thermostatic spring on one end of the shaft, and the counterweight on the other end of the shaft. On eight-cylinder engines, it's usually more practical to have both spring and weight on the same end of the shaft.

Applying newly developed solvent directly to heat riser shaft is said to dissolve lead oxide deposits and free up the shaft in a matter of seconds without the need of tapping or hammering on the unit. For best results, the solvent should be applied when the manifold is cold.

HEAT RISER CONSTRUCTION

Basically, an average heat riser consists of a valve plate, a shaft, a thermostatic spring, and a counterweight. The valve plate, mounted on the shaft, works inside the exhaust manifold. The shaft extends outside the manifold through accurately drilled holes, which also act as a bearing surface for the shaft.

On the shaft, outside the manifold, is mounted a spring. The spring is constructed of two ribbons of dissimilar metal—usually brass and steel—which are fused together, then wound in the shape of a coil. One end of the coil butts against a stop. The other end fits into a slot cut into the damper shaft. Also clamped onto the shaft, outside of the manifold, is a large heavy counterweight.

And that's all there is to the complete assembly — a plate, a shaft, a spring, and a counterweight.

HOW HEAT RISER OPERATES

In good condition, a heat riser works like this: When the engine is cold, the thermostatic spring contracts into a tight coil. Because one end of the spring is against the stop, the spring, in contracting, imparts a rotary motion to the valve shaft, which, in turn, closes the plate within the exhaust manifold.

When the engine is started, hot exhaust gases strike the closed valve plate, and are deflected against the intake manifold—in some cases, actually through passages cast in the carburetor base—before passing out through the remaining exhaust system.

Directing hot exhaust gases around the passages, which conduct incoming fuel-air mixture, makes for better vaporization. This, in turn, helps the engine warm up quickly, reducing oil dilution, and cutting down engine wear.

As the engine approaches normal operating temperature, the coiled spring expands and attempts to straighten out. Because one end of the coil remains stationary, all motion is transmitted at the other end, which is locked in the slot cut in the shaft. Therefore, the expanding spring rotates the valve to the "open" position. Exhaust gases are now free to flow directly out the exhaust system without detouring around the intake manifold.

COUNTERWEIGHT ACTION IMPORTANT

The counterweight also plays a very important part in the scheme of things. Without it, the heat valve could not operate satisfactorily.

Basically, the entire unit could be termed a velocity-type valve. This means the plate is mounted "off-center" on the shaft. The velocity of the exhaust gases tend to cause the valve to open. The counterweight exerts a force in the opposite direction tending to keep the valve closed.

If the counterweight were missing, broken, or loose on the shaft, the valve would open much too soon by action of the rapidly moving exhaust gases.

And here's another big item, the counterweight tends to partially *close* the valve at low engine r.p.m., even long after the engine is thoroughly warmed up, in fact, regardless of engine temperature.

This is a very valuable action which helps prevent ice forming on the edges of the carburetor throttle plates. Often severe cases of carburetor icing can be traced directly to a malfunctioning heat riser.

HEAT RISER FAILURE

Through the years, the benefits of a heat riser have been offset, to a large degree, by the inability of the unit to function satisfactorily for any length of time. Because of its location, directly exposed to a hurricane of red-hot exhaust gases, it is vulnerable to deposits of lead oxide which tend to form on the valve shaft seizing it to its bearing surfaces. When this happens, the valve is "stuck," and can no longer provide the service for which it was designed.

Heat risers require only a minimum of care. A quick inspection will determine if the unit is operative. This

(*Continued on page* 51)

By HERB CARRIER
Detroit Editor

Full air, torsion bars, torsion bars with automatic levelizing, or coil-air combinations—all these are possible answers to . . .

Which way suspension?

• TO PROPERLY SUSPEND trousers, Englishmen prefer "braces." American men wear belts. Teenage boys just let 'em hang—usually about half-mast.

But, generally, it's conceded that trousers must have some means of support. It's only a question of how it's done.

While automobile manufacturers aren't particularly interested in methods of proping up men's pants, they are *vitally* concerned with suspension—chassis suspension, that is.

As a matter of fact, the whole topic of new suspension systems has just about taken over automotive conversation, be it professional, service, or just public chatter.

CONVENTIONAL SUSPENSION RIDES GOOD

Automotive suspension systems have come a long way since a ride in a car was considered emergency treatment for one who swallowed medicine without first shaking the bottle.

For quite a number of years, independent front wheel suspension, double-acting shock absorbers, and constantly improving road conditions have all but eliminated the danger of shaking loose dental fillings while enjoying a ride in the country.

Even during a savage "Belgium Block" proving ground run, test drivers seldom develop tatooed posteriors as they did in the "good old days."

PROGRESS, IMPROVEMENT, CHANGE

Consequently, it can be assumed that modern cars ride very well. And they do. Very few people complain of "hard riding" anymore.

Why, then, the big switch in suspension?

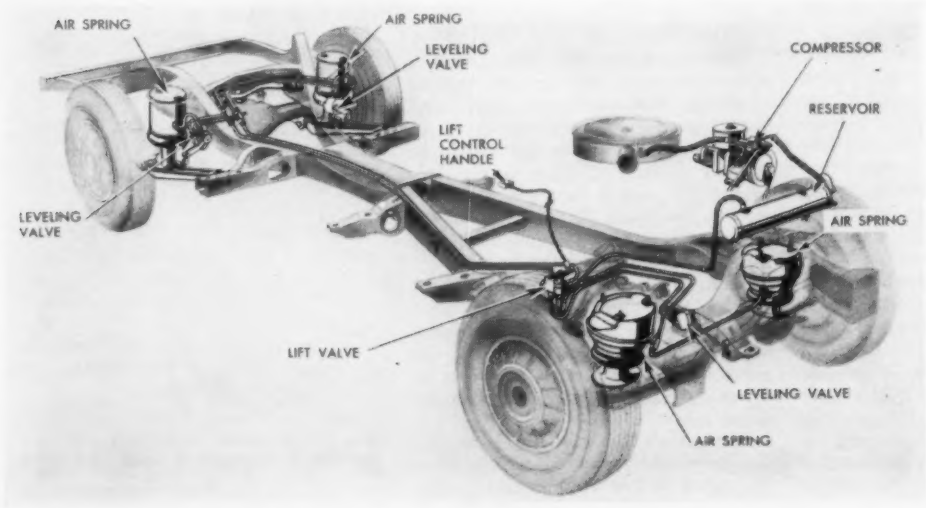
Progress? Of course. Improve the product? Certainly. Change for change sake? Possibly. But the apparent lack of need for radically improved riding comfort is only one part of the suspension story. There are other angles.

For example, road stability, especially during high speed driving, is very important. "Nose-diving" during braking, or excessive rear end "squat" during acceleration are also important. And maintaining constant road clearance height regardless of load, or load distribution, is an especially acute problem with the low, lower, lowest new cars.

MAJOR NEW SYSTEMS

Currently, there are two—possibly three—"new" suspension systems being used on production American cars.

System No. 1 is full air suspension which utilizes air bags in lieu of metal springs at all four wheels. (Editor's Note: Full air suspension was described in the December 1957 issue of Automotive Service Digest in the article beginning on page 12.) This system has various adaption techniques, design differences, and service



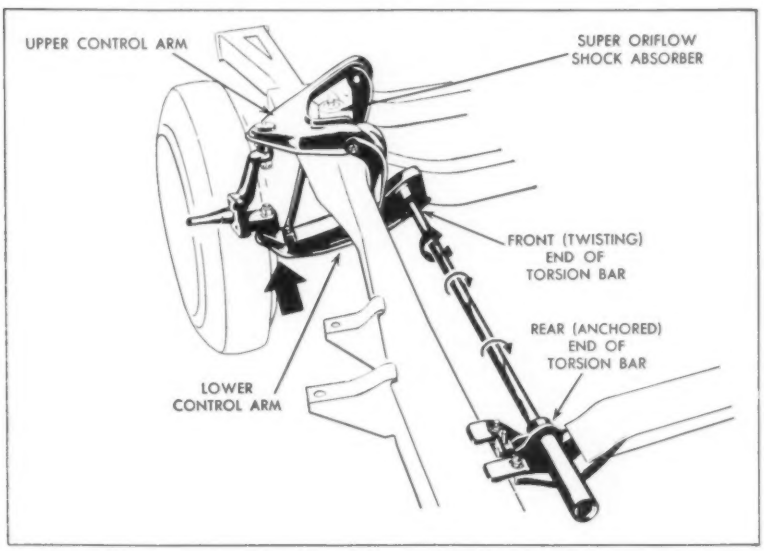
Full air suspension on 1958 Cadillac. This is a self-contained system employing a compressor and reservoir. The automatic leveling feature maintains a constant ride height regardless of load.

requirements according to make of car.

ADVANTAGES

All full air suspension systems are self-contained. That is, they employ a compressor, an accumulator, and, in some cases, storage tanks. These components are in addition to the air bags and the plumbing. Full air suspension by lessening wear and tear due to road shock, or any such claim, but definitely by maintaining front end alignment.

As any front end mechanic knows, the best caster, camber bit he can do will be way out of whack unless vehicle load is always the same as it was while he was making his front end alignment.


UPPER CONTROL ARM
SUPER ORIFLOW SHOCK ABSORBER
FRONT (TWISTING) END OF TORSION BAR
REAR (ANCHORED) END OF TORSION BAR
LOWER CONTROL ARM

Typical front wheel torsion bar suspension system is a simple, clean installation with a minimum number of moving parts. The front end of the torsion bar fits into the lower control arm. The rear end is incorporated with a mutual leveling device which permits height adjustment to compensate for any "settling" due to normal wear. Both ends of the bar are hexagon shape to provide flat working surfaces. Up and down motion of the wheel results in a twisting motion of the torsion bar to absorb road shocks.

with its automatic leveling features serves to correct a big problem, that of maintaining constant ride height regardless of load. There are two or three reasons why this is good:

First, it gives the all-necessary ground clearance. Even a heavily overloaded car equipped with full air suspension will automatically level itself out to design road clearance.

KEEPS HEADLIGHTS IN ADJUSTMENT

This feature, in turn, results in several more "pluses." One, the headlights will always remain in adjustment. Improper headlight aiming, particularly with dual lamps, can be very unhealthy. Trying to guide one car safely passed the blinding glare of several approaching cars is an American version of "Russian Roulette." Sooner or later someone is in danger of getting killed.

So, by virtue of an automatic leveling device, full air suspension eliminates a potential danger spot.

Too, full air suspension should increase tire mileage. Oh, not so much

Torsion bar action can be clearly illustrated by holding one end of a ribbed garden hose stationary and twisting the other end. The ribs will indicate the amount of twist. When the hose is released, it assumes its normal shape.

Constant running with Junior at the wheel, and eight or nine of Junior's 200-pound playmates in the rear seat, will chew up tires regardless of proper alignment for normal loads. So, here is another outstanding benefit from the automatic leveling feature of full air suspension.

The negative side of full air suspension has also been voiced. "Something else to go wrong" can be heard quite often. "Costs over a hundred bucks. That's too much for what you get out of it" is another minus. "Who's going to fix it? Good mechanics are scarce, and air suspension is bound to require expert, costly service" is another man-on-the-street comment.

SOME MERIT

Some of these pessimistic views have merit. Air suspension is an extra-cost option on most all cars. Although, people can pay an equal amount for some car radios, or a set of special tires.

The "more gimmicks — more trouble" school also makes sense. But, here again, air suspension should not be a chronic source of malfunction. Basically, most air systems are really quite simple. Air compressors have been used on vehicles for years. They're well understood by practically all working mechanics.

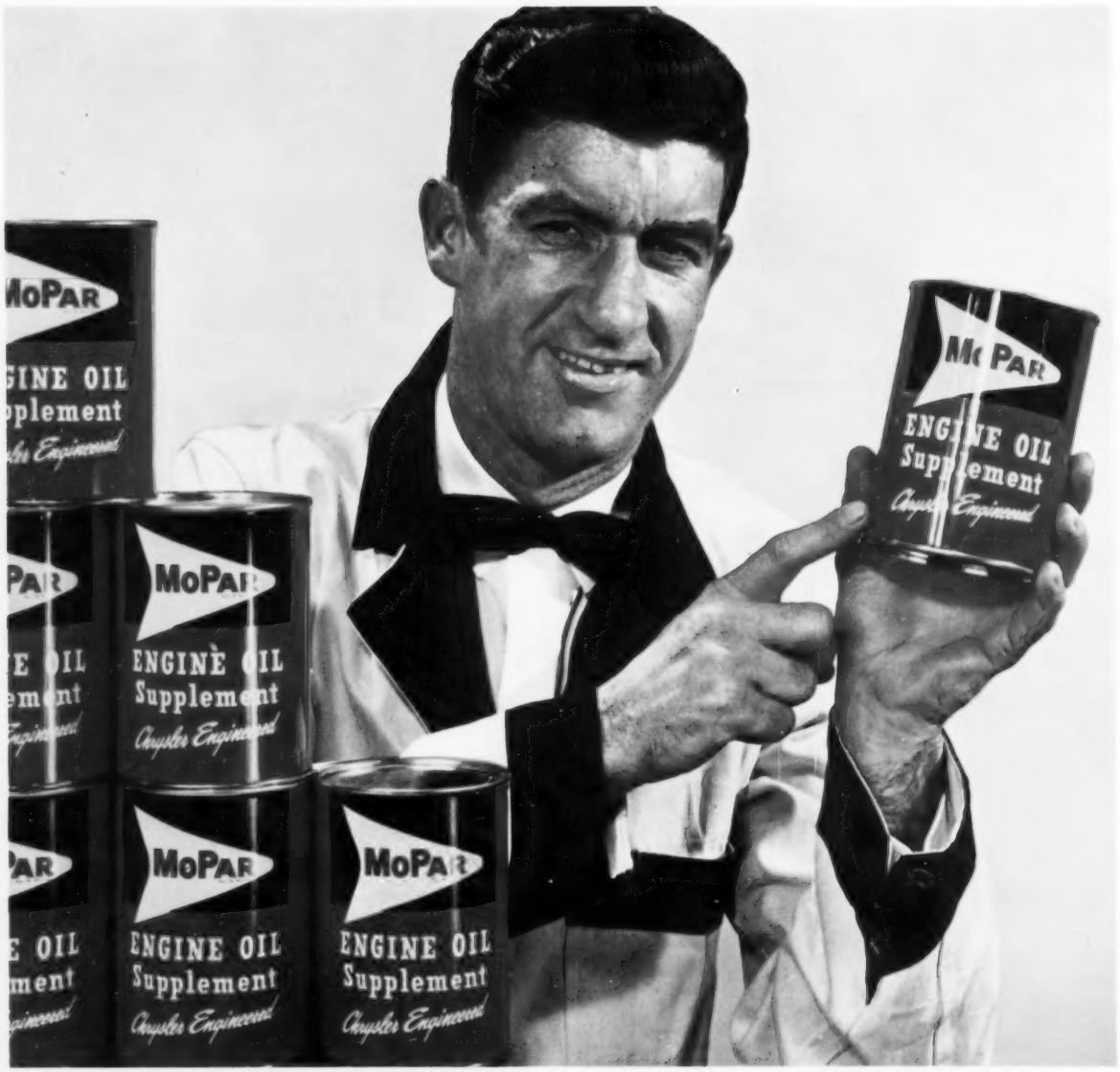
The plumbing is usually nut and flare copper tubing with a few flexible lines where needed. Hydraulic brake and gasoline lines are very similar. The air bags themselves should last for years. If they do go bad, replacement is no particular problem. Certainly, not much more complicated than replacing conventional springs.

The leveling valves may be classified as brand new, but they're only valves. Besides, in most instances a defective valve would be replaced with a new one. Installing a new leveling assembly wouldn't stump a mechanic.

Mechanics are a pretty shrewd bunch. Most will soon have air suspension problems in their "hip pocket."

TORSION BARS

"New" suspension system No. 2 involves the use of torsion bars to replace the front coil springs. The rear springs are the conventional leaf design. *(Continued on following page)*



GREAT NEW *MoPar* MERCHANDISING PACKAGES ...TO HELP YOU SELL!

Here's a proud, colorful new MoPar package that brings Chrysler Corporation's Forward Look right to the spot where you show and sell.

It adds a salesman to your payroll if you'll just put it to work—displayed on the counter, in the window, on the floor. It's a stopper any place, it says "years-ahead engineering" all over it, and it can put an important new push behind your over-the-counter sales.

The time to put this bright new package to work is right now. Set up a display with one of your car care products—like MoPar Engine Oil Supplement—and see if it doesn't build sales for you on sight.

to all our friends selling and using *MoPar* products:

You see here the newest step forward for the Forward Look.

It's an attractive, colorful package design, created for MoPar by one of the nation's foremost industrial designers. We feel that it brings to the *outside* of the MoPar package the same years-ahead thinking that you expect from Chrysler Corporation on the *inside.*

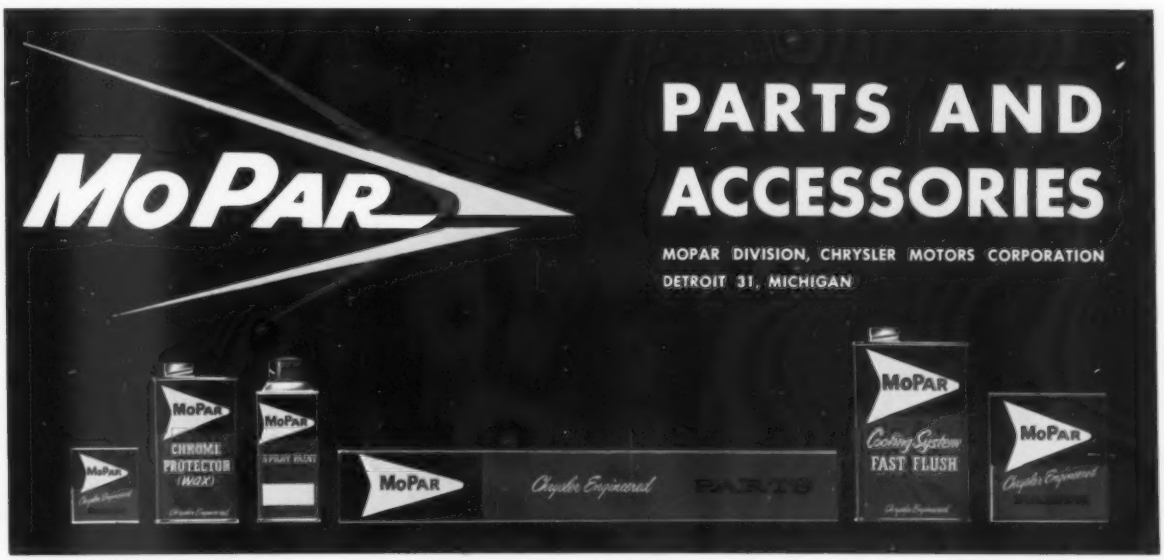
As the year goes along, you'll see more and more MoPar products packaged in containers carrying this new design.

And the products inside maintain the same high standards that make MoPar quality unquestioned. Every MoPar part and accessory is precision-engineered to Chrysler Corporation's rigid *original equipment* standards, to insure operating efficiency under all driving conditions.

We hope that you'll make full use of new display possibilities created by this clean, colorful packaging design. It is another big step forward in building even greater public demand for our *official, authentic* Chrysler Corporation parts and accessories—*MoPar.*

T. E. Wattpall

PRESIDENT, MOPAR DIVISION
CHRYSLER MOTORS CORPORATION



By incorporating air bags with specially designed rear coil springs, American Motors has a unique suspension system that is simple, low in cost and effective. As a safety feature, if air pressure should fail the car can still be driven without too much difficulty.

Suspension . . . CONTINUED

Full torsion bar suspension has been used on a number of production automobiles, but by far the greatest number of torsion bar systems only include the front wheels.

While this type of suspension does not have automatic leveling, it does have a lot in its favor.

STANDARD EQUIPMENT

For one thing, it's standard equipment—not an extra-cost option. This helps soothe the new car buyer. He's getting an outstanding new suspension system without having to pay extra for it.

Mechanically, torsion bar suspension is a clean, simple mechanism. There are a minimum of parts that could be termed "moving."

Also, there are no lube points to worry about. A twisting action of a metal bar replaces the conventional coil spring.

TROUBLE-FREE

Naturally, you'd suspect a system as basic as this would be a source of very little trouble, and according to the service engineers, this kind of torsion bar suspension is virtually trouble free.

Factory figures indicate less service requirements for torsion bars than for the older conventional suspension.

The low cost, standard equipment feature combined with high mechanical dependability give torsion bars strong selling points.

DISADVANTAGES

However, like everything else. current torsion bar suspension leaves some room for improvement. Mostly, people mention that the lack of automatic leveling constitutes a major disadvantage.

This may be true. Automatic leveling through use of electric motors has been tried with torsion bar suspension, but it led to service complications. Electric motors can be balky at times, especially when they are exposed to inclement weather. Then, too, some people feel that the use of electricity for accessory operation has almost reached the saturation point.

Another minus value mentioned in regard to torsion bar suspension is that it doesn't have the degree of variable spring rate that accounts for the excellent ride control of full air suspension.

This, also, may be true, but this, as torsion bar enthusiasts argue, is the function of a shock absorber—not of the suspension system.

SHOCK CONTROLS RATE

A well-designed shock absorber tends to control spring rate (or rate of bounce) to suit the immediate road conditions. An air system without shock absorbers wouldn't be nearly as effective.

Therefore, the torsion bar people assert, shock absorbers might be a truer answer to the reason for the "Super-Boulevard" ride than the actual design of the spring.

The No. 3 entry into air suspension recently made its debut on American Motors cars.

They have attacked the problem in a slightly different fashion—and their reasoning makes a lot of sense.

For example, American Motors engineers conclude that any added weight placed in a vehicle would primarily affect the rear springs only.

This certainly sounds logical. Usually, only the lucky deer hunters have occasion to place an added load on the front fenders.

REAR WHEELS ONLY

Following this line of thought, American Motors engineers built air bags into the rear suspension only. And, these air bags work *inside* and in conjunction with a pair of low-rate coil springs.

An engine mounted compressor and a 300-pound reservoir supply air to the rear units through Nylon tubing and the necessary flexible rubber hose.

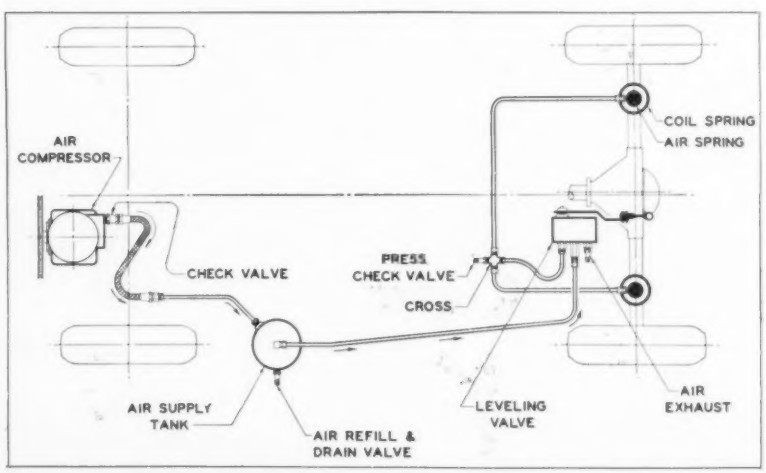
AUTOMATIC LEVELING

Automatic leveling to compensate for extra load is accomplished by a leveling valve mounted on the underbody and connected, through linkage, to the rear axle housing.

This leveling valve is of the time-delay variety which assures no leveling action during transient motions of the suspension system.

Inside the hard plastic body are two spring-loaded valves. One of these valves allows air to escape from the air bags, and the other valve admits air from the reservoir.

The motion of the lever attached to the axle housing is dampened by a silicone dashpot. The amount of time delay is determined by the degree of



Rear air suspension is unusually "clean." Note the lack of excess "plumbing." The same basic units are used with full air suspension—an engine mounted compressor, a reservoir, leveling valve and air bags.

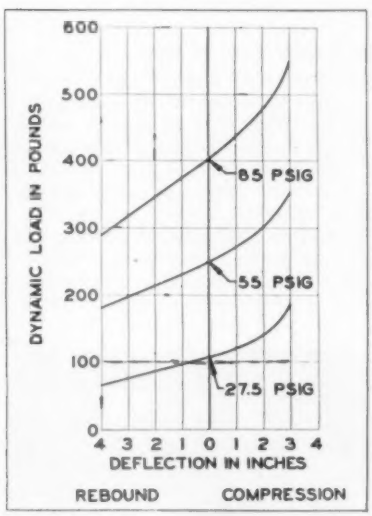
damping designed into the dashpot

The leveling link is adjusted to provide the recommended overall vehicle height. This is accomplished by letting air into the bags in direct proportion to added weight. Then, when the car is empty, only enough pressure is left in the bag to keep it from wrinkling.

ADVANTAGES

American Motors lists the following major benefits for their new air suspension system:

1. Constant riding heights at the rear of the car regardless of load.
2. Headlamp aiming does not vary with vehicle load.
3. Air suspension cars are normally lower than American Motors cars with standard suspension.
4. Increased driver control during severe bumps because spring rate increases in proportion to severity of bumps encountered.
5. Increased stability during cornering due to proportionate build-up of the rate of the air springs. This results in better rear-end control.
6. An excellent boulevard ride.

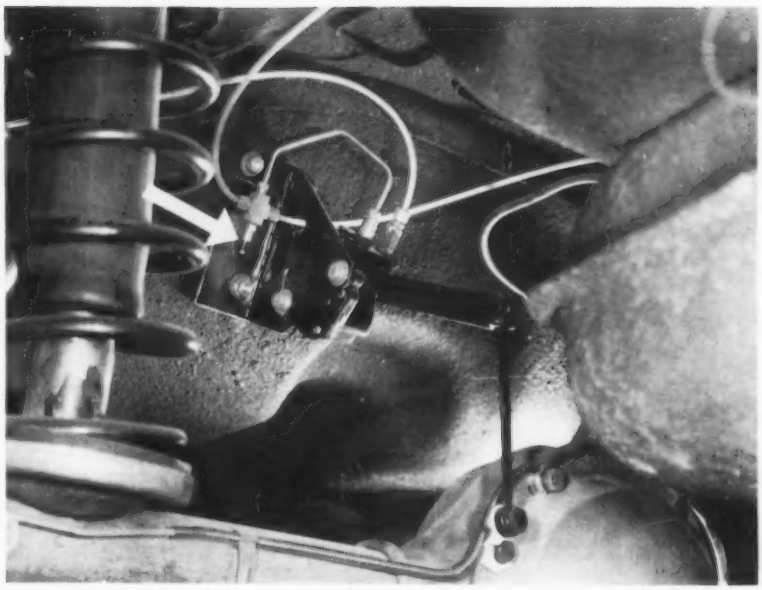


Air spring dynamic load vs. deflection. When American Motors cars are empty, a minimum pressure is contained in the air bags to prevent them from wrinkling. As dynamic load increases, air pressure goes up in direct ratio to enable the air bags to carry a proportionately higher amount of the total load.

FUTURE TRENDS

In any discussion of new developments, there usually is some crystal-ball gazing as to the general future trends.

The question of "which way suspension" brings up some interesting answers.



American Motors leveling valve is connected between the rear axle housing and car underbody. A Schrader valve (arrow) on the cross fitting provides a means of making pressure checks. An eccentric on the linkage allows adjustments to compensate for settling or driver riding height preference.

Which way do you think it will go?

Will full air suspension vehicles continue to grow in volume to a point where the price will come down, and actually be low enough to be included as standard equipment?

Will torsion bar suspension incorporate automatic leveling to give it an impressive, all-advantage standard equipment suspension system?

(Note: There have been some rumors around Detroit to indicate that, perhaps, a central hydraulic system is being developed to provide inexpensive, automatic leveling action for torsion bar suspension as well as a source of power to operate other accessories.)

Or, does American Motors have the answer with combination air-coil rear suspension?

At this writing, who can say which way it will go? A personal opinion, growing out of a healthy respect for the imagination and ingenuity of automotive engineers, would be that when several groups of talented technical brains work on a problem with a common goal, they usually find that "there's more than one way to skin a cat!"

Here's Why Contact Points Burn or Become Pitted

How many times have you been asked, "What causes the points in my car to burn or pit so badly?" . . . and what was your reply? A good answer to this question is contained in a recent Auto-Lite Service Bulletin, which states:

"Ignition contacts are required to break an electrical circuit many times a second. This creates an arc which the condenser is unable to completely prevent, as it is designed to operate over the entire speed range. The arc results in some metal transfer and the formation of some tungsten oxide. Normally this transfer is very slight and the tungsten oxide flakes off.

"The main cause for contact deterioration is excessive heat developed either due to high resistance contact or to higher than normal primary current. High primary current allows tungsten oxide to coat a large area on the contact face, which does not flake off. This results in high resistance between the contacts which prevents proper coil action. Oil or dirt on the contacts, even in minute quantities, becomes burned by the arc. This increases the resistance of the contact which increases the heat as well as reduces the primary current. Usually these defects are cumulative so that the condition becomes worse once it has started.

"If the condenser actually becomes defective, the amount of pitting is so extreme that it is not difficult to recognize."

* * *

More than seven million Americans are employed in the manufacture, sale, service and use of motor vehicles—one of every ten persons gainfully employed in the nation.

AUTOMOTIVE TECH KNOW-HOW

Road testing inside the shop

How scientific diagnosis with the dynamometer installation meets the challenge of obtaining peak performance from the ignition, fuel and mechanical systems of today's high-power, higher-compression engines.

● THERE WAS A TIME when the service manager, foreman or senior mechanic would take the customer's car out on the road after a tune-up or overhaul job to get the "feel" of the car under actual operating conditions. Many used the "road test" to see if service work that had been done was really checking out OK.

But, taking a customer's car on the road can prove to be a risky and dangerous thing, and with traffic getting snarled up more and more in cities and rural areas, the practice of making a "road test" is rapidly becoming a thing of the past. Most shopmen realize, however, that making a lot of tests, primarily with an engine idling or speeding up a bit, does not necessarily mean that the car in which this engine is installed will zoom out and perform right up to standard on the road, as its maker intended.

So, once again, shop equipment makers came to the rescue. Thus, the chassis dynamometer made its appearance some years ago; and more and more is proving its worth in the service shop as a vital and necessary piece of equipment to complement conventional engine tune-up equipment.

THE WIDE OPEN SPACES—IN A SERVICE STALL

The dynamometer brings simultaneously to the shop, a speedway for open throttle testing under load, and a hill for checking pulling power. And all this on a level floor within the confines of one service stall—truly a small edition of the industry's great proving grounds where experimental and production cars are performance-checked and measured—under load.

A study made by Cities Service Research and Development Co. has verified that the important factors of carburetor air temperature, water jacket temperature, and

Dynamometer installation with complete instrument panel. In foreground are the rollers on which the back wheels of the car rest during test. Included in the instrument panel assembly are: speed indicator calibrated in miles per hour; tachometer, which reads in rpm; manifold vacuum gauge; power meter, showing engine load in horsepower; dwell meter; combustion analyzer.

By FRANK WEST

crank case oil temperature, are so close to actual road load conditions in dynamometer tests that dynamometer check-ups, for all practical purposes, are equivalent to road check-ups. There is the added advantage that detailed tests with instruments can be made in the shop which could not be made on a car in motion on the road.

The chassis dynamometer usually has two parallel rollers between which the rear wheels of the vehicle are placed. One roller is an idler and the other drives the power absorption unit and an inertia flywheel. The flywheel can be connected or disconnected at the will of the operator. Instruments on the panel indicate the vehicle speed in miles per hour and also the horse power output at the rear wheels. The amount of water that is allowed to be in the power absorption unit determines the load that is put on the engine. The flywheel weight and proportions are such that it gives approximately the same effect as accelerating the car on the road.

FULL OR PART THROTTLE TESTS

When diagnosing an engine on the vehicle analyzer or dynamometer, the horsepower meter reflects the horse power of the vehicle, or its ability to perform in the owner's hands. Tests are made at wide open throttle, and therefore the horsepower at any selected speed is dependent on the condition of the engine.

It is also important to know how the engine performs at part throttle to cruising load carburetion, ignition advance, etc. At any throttle position between closed and open, the power output of the engine at any given speed is dependent on both the amount of throttle opening and the engine's ability to perform. Therefore, we must know the amount of throttle opening in order to compare the engine condition to known cruising load standards.

Fortunately, it has been found that there is fairly close correlation between percent of throttle opening and the engine manifold vacuum. For example, 18 to 20 inches of vacuum would be zero opening, 0 to 1½ inches would be 100% open position. Approximately 10 inches would be half throttle, 5½ inches three-quarter throttle, and so on.

THREE BASIC ELEMENTS

The basic elements of engine performance are three in number:

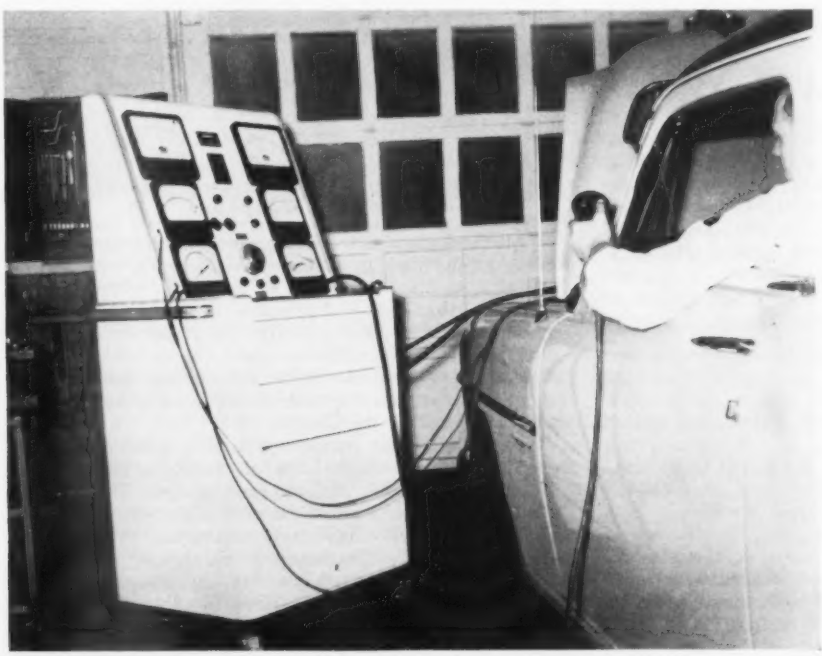
1. Compression
2. Carburetion
3. Ignition

For an understanding of the procedures used for testing each of these systems of the engine, it is necessary to discuss them separately. The discussion may make the analysis appear to be a time-consuming process, but in actual practice such is not the case. For example, if at selected test loads and speeds, the carburetor's air-fuel ratios are found to be correct, the entire fuel system can be checked off as satisfactory. If the engine is hitting on all cylinders during these same speeds and loads, and no power is gained by adjustment of ignition timing and the cam angle is correct, the entire ignition system can be eliminated as a cause for complaint. Thus in a matter of 3 or 4 minutes, if the complaint was "low power" the trouble could be allocated to "compression" as the probable element at fault. A careful check of compression would verify or disprove this.

COMPRESSION

The maintenance of high, uniform compression is necessary to get peak performance in modern engines. However, measurement of compression on an engine at work is impractical in the absence of a dynamometer. Compression testing on the dynamometer measures the operating effects of good or faulty compression by measurement of results. Two similar engines might show the same satisfactory compression readings when tested at cranking speeds and temperatures, but one of them may deliver considerably less power than the other under full throttle operation, because of compression losses caused by sticking valves or warped valves, reduced valve lash, blow-by of thinned oil, or other problems created by the

(Continued on following page)



Seated in the car, the operator controls the loading on the engine by a hand switch. Under his command and observation, the car is subjected to conditions equivalent to actual road loads.

The Dynamometer . . . CONTINUED

engine under working conditions.

Compression effect measurements are usually used to locate the possible source of such troubles or complaints as:

1. Low power, sluggish engine
2. Poor acceleration
3. Low gas mileage
4. High oil consumption
5. Excessive breather fumes
6. Smoke at tail pipe, after deceleration
7. Engine missing due to fouled plugs
8. Engine rough at idle and on heavy pull

Some of these symptoms could come from causes other than faulty compression, such as timing, carburetion, burned heat riser, oil leaks, excessive valve guide wear, etc.

MAKING COMPRESSION CHECK

To diagnose compression, on the dynamometer, the automobile is driven on the testing machine and warmed up by driving it at 35 to 40 mph, with 15 to 25 h.p. showing on the h.p. meter on the instrument panel. At the same time the operator will listen for piston slap, pin and rod noises indicative of wear responsible for compression loss and oil consumption. The use of a soundscope will help to pick out objectionable noises.

When the engine gets up to operating temperature, it should be loaded so that at full throttle the speed will be 25 mph, because maximum compression leakage will occur at relatively low engine speeds and high explosion pressure. The vacuum reading should be 1" Hg. or less. Now each plug is shorted out in turn, noting the drop in h.p. on the h.p. meter for each cylinder. If the plugs are firing satisfactorily, a major difference in h.p. drop from one cylinder to another indicates a loss of compression through piston rings, valves, or head gasket.

(1) To check for rings and piston-cylinder condition, remove breather cap and note crankcase breathing while running at 25 mph with open throttle. If blow-by is noticed or the sound is changed when plugs are shorted, it is indication of loss of compression by the rings. If blow-by level is greatly reduced while shorting out one cylinder, this points to stuck rings or a scored cylinder. If compression loss is not apparent here, a check should be made for faulty valves.

(2) In the previous test, uneven h.p. drop when shorting plugs without excessive blow-by or change in breather noise would indicate leaky valves. The car should be run on the dynamometer at 40 mph with full throttle for the equivalent of a mile or two, then shifted into neutral and the engine allowed to drop quickly to idle speed. Erratic, uneven, low vacuum or valve noise of short duration not noticed before, indicates sticking or sluggish valves or insufficient valve lash.

(3) To check for possible leaking head gasket, inspect radiator water for bubbling while the engine is running under load. The plug shorting test will reveal two cylinders side by side which are weak, if the head gasket between cylinders leaks.

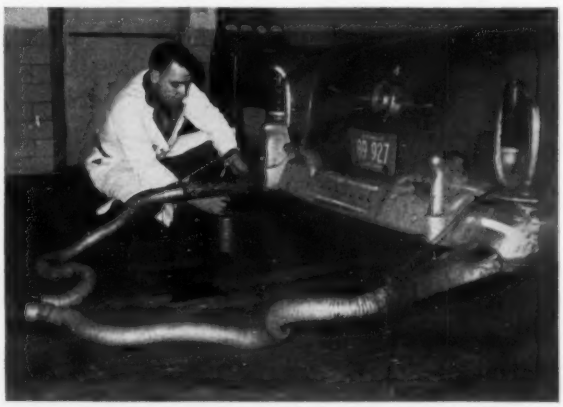
From the observations made in the above tests, made on the engine while at work *under load*, compression troubles can be diagnosed quickly and specifically in a total time of five minutes or less, and simultaneously with overall vehicle analysis. In view of the steadily increasing value of shop labor time, it should be quite apparent that the dynamometer offers a means of major economies in diagnosing troubles of various kinds.

Carburetion may be tested on the dynamometer to show the overall relationship of carburetion, fuel system, fuel, engine, and vehicle in a simple, quick and conclusive manner.

The complaints or symptoms that should be examined and considered are:

1. Low gas mileage
2. Low power, poor acceleration
3. Flooding, hard starting
4. Rough idle
5. Backfire, high speed fade-out
6. Flat spots, surge

As in the Compression Analysis, these or similar customer-reported or observed symptoms do not necessarily mean that the carburetor is at fault, though it may



"Siamese" connection to ventilating system is required for dual exhaust systems. The combustion analyzer pick-up is located inside one funnel.

be. The purpose of dynamometer in diagnosis is to pick out and prove the specific trouble that is responsible for the unsatisfactory operation of the vehicle, as well as to demonstrate its actual effect as on the road.

Considering the carburetor, we see that it consists essentially of four systems or circuits, which are:

1. Idle circuit
2. Main or cruising circuit
3. Power circuit for full power operation
4. Accelerating pump circuit, to prevent lean mixtures during transition from idle to main circuit, or when accelerating

All these systems overlap each other and must operate properly, each at its proper time and load condition, as well as in cooperation with one another. Complete carburetor analysis is impossible therefore, unless each system is checked individually, which can be done only during road load conditions, readily accomplished on the dynamometer, plus use of the exhaust gas analyzer. The vacuum gauge and the tachometer should also be used, and connected to the engine.

The exhaust gas analyzer is necessary to indicate the proportions of gasoline and air mixture going under different conditions of load and speed. The vacuum gauge is used to indicate the degree of throttle opening.

The first check of carburetion should be made at open throttle to be sure the engine is warm. Low speed part-throttle checks should follow the high speed test to be sure of a clean intake manifold.

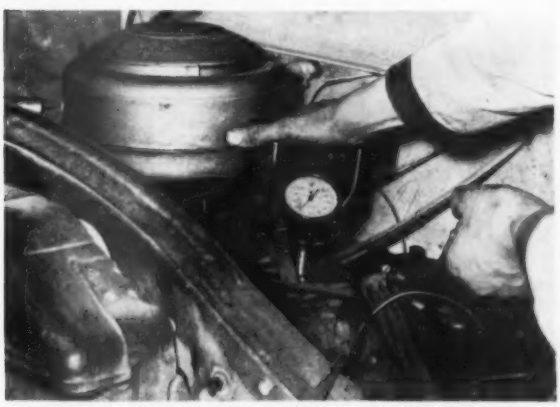
To make the test, the operator gets in the car, with

load control in his hand and the combustion analyzer, properly calibrated and ready for use, on the seat beside him where he can see it. The engine should be brought to about 25 mph with open throttle, and combustion reading noted. Next the load should be released until the engine speeds up to 40 mph or about 2000 rpm full throttle. Note combustion reading, which should be between 12.5 and 13.5 to 1 air-fuel mixture, or 75 to 81% combustion efficiency unless otherwise specified for the particular car being tested.

Next the throttle is slowly closed, reducing the dynamometer load if necessary to obtain a reading of 10 inches vacuum or more (half throttle or a little less) at 30 to 35 mph. The power step-up system should close and the combustion analyzer should swing toward the lean side. Now the throttle should be gradually opened, with the operator watching the vacuum gauge. As the vacuum drops to 6 to 7 inches, gradually lower it still more by throttle or load, and watch both the vacuum gauge and the combustion analyzer. The metering rod or valve should open for full power mixtures at between 6 and 3 inches of vacuum. Refer to vehicle specifications for correct figure. The combustion meter should swing toward rich at this time. This finishes the check of the *power system* of the carburetor.

CHECKING ACCELERATING SYSTEM

To check the accelerating system of the carburetor, the throttle should be pumped two or three times with the dynamometer loaded to hold engine speed at 40 mph with full throttle. The combustion meter should show a momentary enrichment of the fuel-air mixture, equivalent to about one ratio as compared to that found at full



Compression pressure testing is a necessary check on the value of engine load testing, which is ineffective if compression pressures are unequal. Whenever there is more than 10 psi difference between any two cylinders, the cylinder leakage test should be made.

throttle at 40 mph. This indicates that the accelerating pump is supplying fuel to the air stream, but does not necessarily indicate that the correct amount is being supplied, which will have to be checked further by seeing that smooth acceleration is possible under given load conditions.

The idle air-fuel ratio should be as lean as possible and still maintain a smooth idle. Usually 11.5-12.8:1, or 67-65% efficiency is about right. This is required for maximum economy and often affects 20 mph cruising load air-fuel ratio if the idle mixture is too rich. Before condemning the carburetor for rich 20 mph cruising mixtures, adjust the idle and recheck. Set the idle in accordance with normal procedure or vehicle manufacturer's instructions, especially where automatic transmissions are used. By means of the idle throttle stop the idle speed should be set, and after the idle has had time to stabilize, reset the idle mixture screw or screws. If there are no other faults such as ignition, compression, manifold leaks, high float level, wrong fuel pump pressure, the engine should idle smoothly. If it does not, it is NOT idle carburetion trouble. Remember that no idle adjustment is complete without inspection of the fast idle linkage and adjustment.

This covers checking of the carburetor. If the mixtures other than the idle and accelerating conditions, are not correct, a carburetor overhaul is indicated.

IGNITION

The object of the ideal ignition system is to ignite the air-fuel mixture in such a way that the maximum of smooth, dependable power is produced at the rear wheels. Peak power and satisfactory acceleration can be obtained from our late model high compression engines only with precise ignition timing, with a spark that is always intense enough to fire the combustion chamber charges under all conditions of speed and load.

A fact which must be considered at all times when dealing with the ignition system, is that the higher the compression pressure in a cylinder, the higher will be the initial voltage that is required to ionize the spark gap and cause the passage of a spark that has sufficient intensity to ignite the fuel-air charge. Thus, with compression rations of 10.5 to 1, which are used by some of our current engines, the required voltage may run as high as 25,000 volts, with an excessive spark gap and rounded center spark plug electrode. This means that the available voltage must be at least equal to the required voltage or the engine will misfire.

Ignition timing can be accurately checked on the dynamometer. This timing, to be correct at any given engine speed, depends on everything that influences the speed of combustion. Anything that influences combustion pressure or temperature also influences combustion speed. Some of these are basic engine condition, carbon accumulations in the combustion chamber, rust and scale in the water jacket, fuel, individuality of engines even of the same make and model, and atmospheric conditions.

TIMING MARKS A COMPROMISE

This naturally brings up the question of how an engine can be timed accurately. The timing marks are only a compromise. However, maximum horsepower at every speed as shown up on the dynamometer will indicate that the timing is correct for the specific engine operating under its specific set or combination of conditions. Timing that is either too late or too early will show a loss in horsepower. The engine tells you when timing is right by doing its best work.

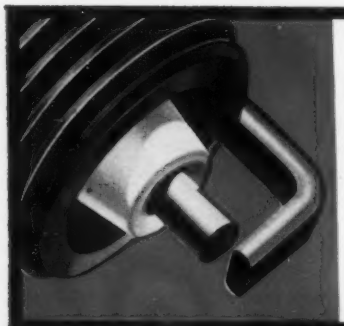
The symptoms that indicate ignition problems are:

1. Engine misses under heavy pull
2. Engine misses at high speeds
3. Engine skips or bucks at cruising
4. Hard starting
5. Engine pings on acceleration
6. Low power, poor pick-up
7. Poor gas mileage
8. Rough idle—stalls
9. Engine overheats

Some of these or similar symptoms may be caused by other than ignition troubles, but a test on the dynamo-

(Continued on page 74)

AUTO-LITE® RESISTOR SPARK PLUG WITH POWER TIP



NOTICE!
You need only 7 Power Tip numbers to cover most of your customers' cars*

BUICK

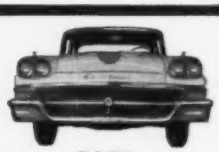
1949-53	Except V8	A82
1953-55	V8 All	A52
1956-57	V8 All	A42
1958	V8 All	A52

DODGE

1953-56	V8	AR52
1957	V8	AR42
1958	V8 Coronet & Royal	AGR42
1958	V8 S. Wag. & Cust. Royal	AR42
1956-58	D500	AR42

EDSEL

1958	V8	BF42



FORD

1952-54	6 Cyl. O.H.V.	AL82
1954	V8 O.H.V.	AL82
1955-56	All 6 Cyl., V8 & T-Bird	BF82
1957-58	6 Cyl. & 292 Cu. In. V8	BF82
1957-58	All Other V8 & T-Bird	BF42

HUDSON

1955	V8 7/16" Reach	AL82
1955-56	V8 ¾" Reach	AG52
1955-57	Metropolitan	AG52
1955-56	Rambler	AL82
1956	Hornet Spec. V8	AL82
1957	All Exc. Metro	AL82

NASH

1946-56	O.H.V. Engines ⅜" Reach	A82
1953-57	O.H.V. Engines 7/16" Reach	AL82
1955-57	O.H.V. Engines ¾" Reach	AG52

OLDSMOBILE

1949-54	V8	A82
1955	V8	A52
1956-58	V8	A42

PACKARD

1955	V8 7/16" Reach	AL82
1955-56	V8 ¾" Reach	AG52
1958	V8	AL82

PLYMOUTH

1955-57	V8	AR52
1958	V8	AR42
1956-58	V8 Fury	AR42

New wall chart specifications are now available showing the one Power Tip number recommended to give top performance for each model

Now you can reduce your spark plug inventory and still cover over 95 per cent of your customers' cars with just *seven* numbers of Auto-Lite Power Tip. Power Tip, engineered by Auto-Lite and proved in millions of American cars, is unexcelled at delivering peak performance at *all speeds.*

Dealers who have used Power Tip know that it's the *safe* choice for today's higher-horsepower, higher-compression engines. That's the reason more and more dealers are going to Power Tip exclusively for V-8's and other overhead-valve engines. Auto-Lite Resistor Spark Plugs with Power Tip are original equipment in all 1956, 1957, and 1958 Chrysler Corporation cars with overhead-valve engines and *must* be used for replacement if satisfactory performance is expected.

Power Tip takes the "guesswork" out of spark plug selection because it "fires up" at *all speeds* . . . from slow-speed city traffic to high-speed highway driving. Install Power Tip in your customers' cars and be sure of complete customer satisfaction on every tune-up job. Stock the *seven* Power Tip numbers *today!*

THE ELECTRIC AUTO-LITE COMPANY • TOLEDO 1, OHIO

POWER TIP . . . the first spark plug

"fires up" at all speeds!

CADILLAC

1949-54 V8.....A82
1955 V8.....A52
1956-58 V8.....A42

CHEVROLET

1949-53.....A82
1954-57 6 Cyl. & V8.....A52
1958 6 Cyl. & V8.....A42
1953-58 Corvette.....A42

CHRYSLER

1951-53 V8 All.....AR82
1954 V8 All.....AGR82
1955 V8 N.Y. & Imper..AGR52
1955-56 V8 Windsor.....AR52
1956-58 V8 N.Y. & Imper..AGR42
1957-58 V8 Winds. & Sara...AR42
1955-57 V8 C300 Series...AGR42
1958 V8 C300 Series...AGR32

DE SOTO

1952-54 V8 All.....AR82
1955 V8 (Firedome S22).AR82
1955 V8 (Fireflite S21)...AR52
1956 V8 Exc. Advent.....AR52
1956-58 Adventurer.....AR42
1957-58 V8 All.....AR42

IMPERIAL

1957-58 V8 All.....AGR42

LINCOLN

1952-54 V8 O.H.V.....AL82
1955 V8 All.....BF82
1956-58 V8 All.....BF42
1956-58 Continental.....BF42

MERCURY

1954 V8.....AL82
1955-56 V8.....BF82
1957-58 V8.....BF42

PONTIAC

1955-58 V8.....A52

RAMBLER

1957-58 6 & V8 with O.H.V..AL82

STUDEBAKER

1951-57 V8 Exc. Golden Hawk.....AL82
1956 V8 Golden Hawk...AG52
1958 V8.....AL82

IF IT'S NOT AUTO-LITE, IT'S NOT POWER TIP!

**Auto-Lite RESISTOR Spark Plug with Power Tip, recommended for long plug life and suppression of radio interference, can be used in place of all STANDARD Power Tip applications shown in these specifications.*

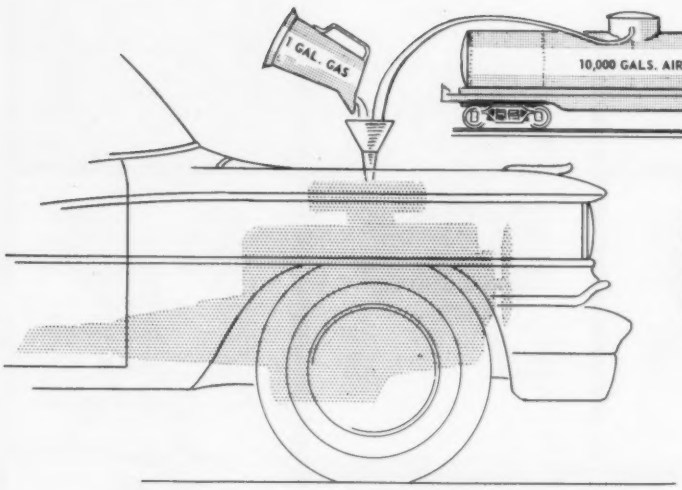
POWER TIP IS HOT AT LOW SPEEDS! At low speeds, the projecting Power Tip is in the thick of combustion where it gets hot quicker and stays hot to burn fouling deposits away *clean.*

POWER TIP IS COOL AT HIGH SPEEDS! At higher speeds, the projecting tip is in the path of the incoming air-fuel mixture where it stays cooler to effectively *check* power-robbing pre-ignition.

ignition-engineered for today's engines!

Deep breathing characteristics of modern carburetion systems, plus the important factor of straining out abrasives and other foreign matter, bring into sharp focus the fact that . . .

Engines must breathe clean air



The importance of clean air entering the engine through the carburetor air horn becomes apparent from the fact that over 10,000 gallons of air are "burned" for every 1 gallon of gasoline. And dirty air, like sandpaper, is rough on engine interiors.

By BEN IKERT, Editor

• MOST OF THOSE in the automotive service business, along with their customers, have a good idea of how much gasoline an automobile engine uses, but chances are few know how much air is used along with that gasoline. The figure is quite startling.

For every 1 gallon of gasoline that passes through a carburetor some 10,000 or more gallons of air must pass through the carburetor air intake to assure the necessary combustible fuel-air mixture for firing in the engine combustion chambers.

FRESH AIR FIENDS

Equally startling is that anywhere from 600,000 to 1,000,000 cubic feet of air are breathed-in by the engine of a car in travelling 10,000 miles. The actual amount of air depends upon the conditions under which the car operates.

No internal combustion engine can operate without air. The high increase in engine power is dependent upon the deep breathing characteristics of modern carburetion systems.

The late model engines need a lot of air—some as much as 450 cu. ft. per minute to develop their maximum power. In this matter of air for engines two things are especially important.

First, there must be a sufficient quantity of air delivered into the carburetor air horn.

Second, this air must be as free from dirt (especially abrasives) as possible.

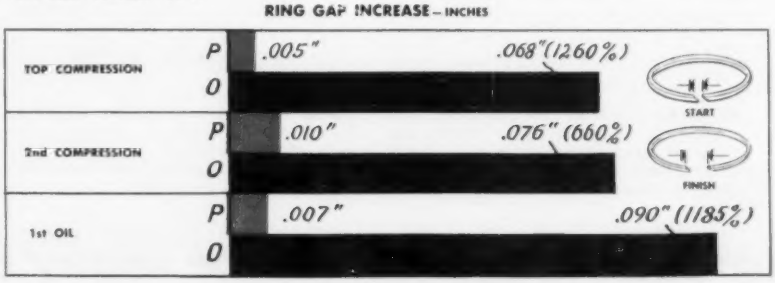
There is a relationship between these two, inasmuch as restriction in the air supply can occur if the carburetor air cleaner is inadequate or badly restricted by foreign matter.

ENGINEERING PROBLEM

Research and experience have shown that some earthy minerals and sands are as hard as steel—some even harder. So, bearing in mind the vast amount of air taken in by an engine for every 1 gallon of fuel the efforts of engineers to keep these scratchy gremlins out of the carburetor air horn by filtration, yet with minimum air restriction, is understandable.

For years, gasoline strainers and oil filtering devices have been used to prolong engine life, but the effect of impurities in the air is not always thought about in terms of possible damage. Besides the visible wind-borne dust and dirt one can see, there are the billions of invisible little particles, constantly suspended in the air. The concentration of dust-laden

Ring gap growth, according to tests, was substantially less with the paper-packed air filter (P). Percentages show the difference in engine wear between the paper and oil-bath cleaner (O).



air varies with locality and conditions, the heaviest being found in dust bowl areas or on dusty gravel and dirt roads.

IT'S AN OLD STORY

The potential damage to engine parts from airborne dust entering through the carburetor was recognized some 30 years or so ago. Early type cleaners were sheet metal cylinders with slots in the side, which merely swirled the air before it went into the carburetor —dirt was supposed to drop to the bottom. Over the years came the oil-wetted cleaner (wire mesh filled with metal shavings dipped in oil) and the oil-bath type where oil, in a reservoir, kept the metal shavings wet by splash.

Two years or so ago marked the trend of the industry to a new kind of air-filtering unit in which metal shavings and oil got an honorable discharge in favor of a completely dry filtering element now commonly called a "paper" or "bone-dry" filter.

But this so-called paper filter, in one make cleaner, for example, actually is a specially-made resin-treated cellulose, closely pleated (for greater filtering surface) and retained in an easily removed cartridge. It came about not as a cheaper device, nor because lower hood lids would not accommodate the oil-bath type (usually greater in height), but because functionally the paper type air cleaner, as emphasized by manufacturers has certain advantages over its predecessors. This, aside from being lighter, more compact and easy to service or to replace the filtering element when necessary.

AIR VELOCITY A FACTOR

An oil bath filter has a disadvantage in that the air stream must strike the oil with sufficient velocity if dirt and dust are to fall out. But as air velocity drops, filter efficiency drops. Therefore, high efficiency is possible only at a high engine rpm and with full power. Thus, an engine operating under extremely heavy traffic conditions may not receive sufficient protection.

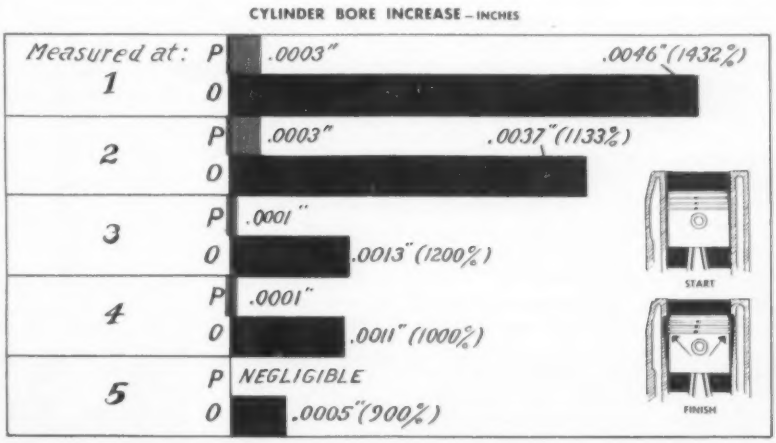
At the lowest air flows, especially after standing, available air flow is insufficient to draw oil from the sump to oil-wet the filtering material. Also, considerable air flow velocity is needed for oil-wetting action when the element is dry. With insufficient oil in the sump, the mesh (the final stage cleaner) is not wet enough. Consequently, only large particles of foreign matter lodge in the mesh, but small ones easily pass through it.

At very high air flows the contaminated particles gain energy fast as the velocity increases, and much of the dust retains enough energy to find its way through the loose filter element ordinarily used in the oil-bath type cleaner.

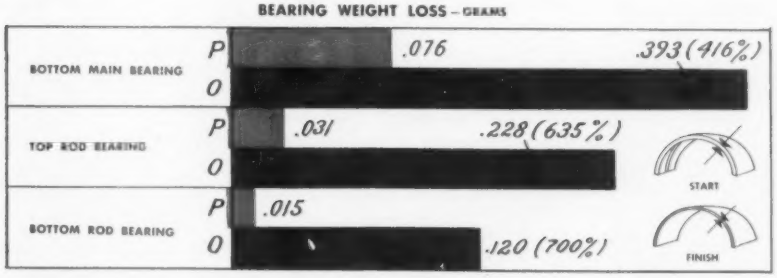
High engine speed can present a problem with the oil-bath cleaner if the oil level is too high in the reservoir. This problem is generally referred to as "oil pullover" which means the filtering oil is sucked through the filtering element into the engine. Dirt and abrasives would be sucked into the engine along with the oil and the effect of these contaminants on engine parts is obvious.

Conversely, the paper pack cleaner uses a much denser filtering element which is constant at any air flow and does not depend upon air velocity

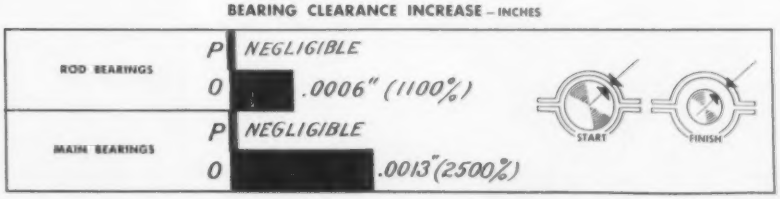
(Continued on following page)



Comparison of the paper air filter (P) with the oil-bath type (O) as regards cylinder bore wear. Test measurements were taken at (1) top ring at top center; (2) bottom ring at top center; (3) intermediate position, (4) top ring at bottom center; (5) bottom ring at bottom center. Percentage figures show difference in wear.



Graph showing difference in wear, or weight loss, of engine bearings (in per cent) with use of oil-bath type cleaner (O) as against paper air filter (P).



Tests showed considerably less bearing clearance increase in the engine fitted with a paper-type air filter (P).

Air Filters . . . CONTINUED

action to provide means of filtration, as lifting oil, but only on flow through the paper. The paper cleaner strains out the dust.

REDUCES TOTAL RESTRICTION

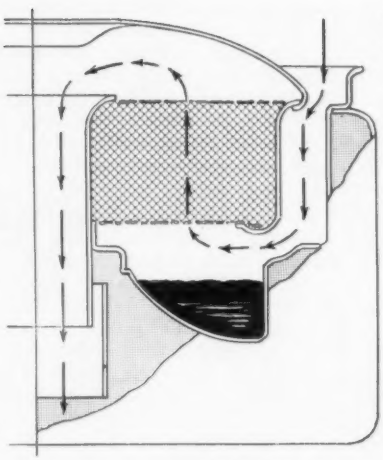
According to engineering tests, the installation of the cartridge into the cleaner assembly actually reduces the total restriction of the cleaner assembly. This is because a more uniform air flow condition is created at the air cleaner outlet when the element is installed. Adoption of a concentric cartridge shows noticeable improvements in engine fuel distribution. Uniformity of air entrance to the carburetor depends largely upon entering conditions at the inlet, velocity through the filter element and the contour of the cleaner cover. A pleated paper cartridge provides a uniform air entrance at the carburetor air horn, as shown in one of the illustrations.

The charts with this article show the difference in engine parts wear of two identical engines, one equipped with a paper air cleaner, the other with a conventional oil-bath cleaner. These charts resulted from dust tunnel tests by the Fram Corp.

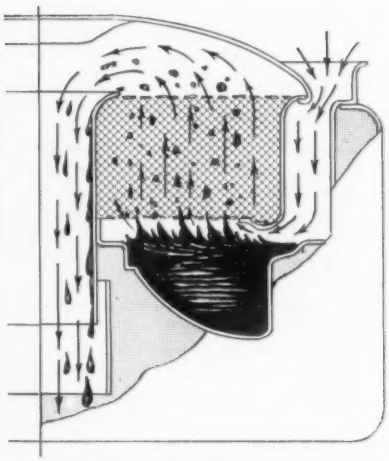
TESTS CAREFULLY CONTROLLED

Each engine was operated under identical controlled conditions of time, speed, temperature and air-borne dirt concentration. The engines had previously been dismantled for accurate measurement of parts. At the conclusion of the tests the engines were again dismantled to wear-check the parts. Each air cleaner was regularly serviced during the test and full-flow oil filters were used on both engines. The charts are indicative of the paper type cleaner's ability to screen out small particles, some so small that they have to be measured in microns, a micron being 30 millionths of an inch!

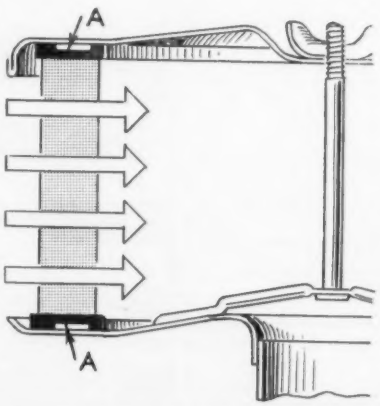
Servicing instructions generally are to remove the cleaner from the carburetor before attempting to service the cartridge. The reason for this is that the dust is so loose on the cartridge that it is possible to spill this loose dust into the carburetor if carelessly handled.



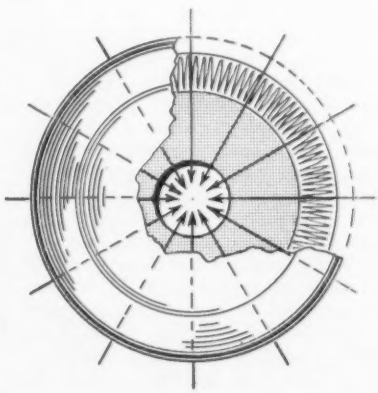
At low speed, particularly when the oil level is low, the oil-bath filter may have insufficient air flow to draw oil from the sump and wet the filter media.



At high speeds, "oil pull-over" through the oil bath filter may permit oil loaded with dirt and abrasives to be sucked into the engine and cause extensive damage.



Paper-pack filters depend only on air flow through paper to achieve filtration. One make has built-in gaskets (A), providing air-tight bond with housing case.



The concentrically-located pleated paper cartridge of the "dry type" filter provides for a uniform entrance of air at the carburetor air horn.

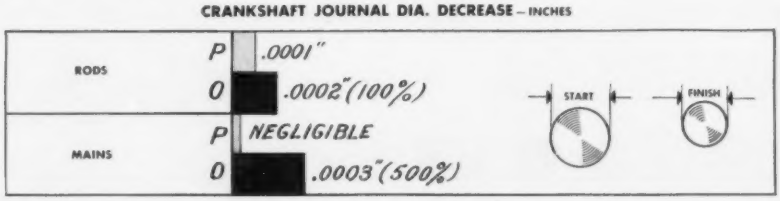
SERVICE IS QUICK, SIMPLE

It is a simple matter to service paper air cleaners. After the assembly has been removed from the carburetor, the filtering element is taken out and rapped lightly, but squarely, on a flat surface. A fine metered flow of air also can be used to force dirt and dust from the filter in reverse direction. Cleaning machines also are available for properly servicing paper air cleaners.

Generally, recommendations are that paper cleaners on cars operating under average conditions be serviced every 2,500 miles and that a new cartridge be installed every 10,000 miles. Some car manufacturers recommend 5,000 mile servicing, 20,000 mile replacement. Others state 5,000 mile servicing and 15,000 mile replacement. But under severe dust conditions, all agree that servicing should be done more often.

It is assumed that those normally operating cars in unusually dusty areas and service shops in these areas, are fully aware of the increased service requirements.

The rod and main bearings of the test engine with the paper filter (graph P) fared better than those of the oil-bath filter equipped engine (graph O).



Technical ideas and business alertness meet in the mammoth showcase of the Pan Pacific auditorium . . . at the

Record Pacific Automotive Show

● LIVING UP FULLY to expectations, Automotive Week for California witnessed the biggest of all Pacific Automotive Shows, ushered in appropriately by highly successful annual meetings of the National Standard Parts Association and the Motor and Equipment Wholesalers Association.

Both NSPA, gathering to the theme "It Can be Great in '58" and MEWA, rallying around its "Blueprint for Progress," enjoyed programs rich in timely and informative discussions.

The big Show itself, opening Thursday, February 20, and running through Sunday, strained the capacity of the Pan Pacific Auditorium and two tent annexes to the last inch of floor space—and possibly to the last spot in the parking area as well. All available booths—750—were utilized to display the wares of 425 exhibitors, Show management reported. Indicative of optimistic viewpoints within the ranks of automotive servicemen, exhibitors found business with jobbers brisk. One large firm, in fact, reported that sales by the end of the first day had more than repaid the entire expense of taking part. New products of many types were studied carefully and keenly.

Invited and urged by wholesalers, dealers, the Independent Garage Owners Association, and other allied groups, the automotive service specialists came out in exceptionally heavy numbers. From Friday evening, when the Show was thrown open to the trade as a whole, through Sunday, the aisles were jammed with interested and critical visitors, eager to see the newest in tools, techniques, parts, accessories, supplies and other products.

Despite the abundance of shop personnel on the Show premises, the increasingly short supply of properly trained manpower was a key discussion point throughout the week. While new technical developments make service work easier, more precise and more profitable, service shops are passing up "millions of dollars in customer billing each year": that was one phase of the warning sounded by Mel Turner, Curriculum Director of the Vocational Schools Program of NSPA. Addressing that Association's meeting, Turner pointed out:

"The healthy ratio is one mechanic for every 60 cars; but even to maintain *the present ratio* of one to every 73 cars, we will need 55,000 new men each year for the next 10 years. Right now, we could use another 150,000 mechanics." He urged all segments of the automotive field to help in attracting boys into the field and in promoting modern teaching methods and equipment.

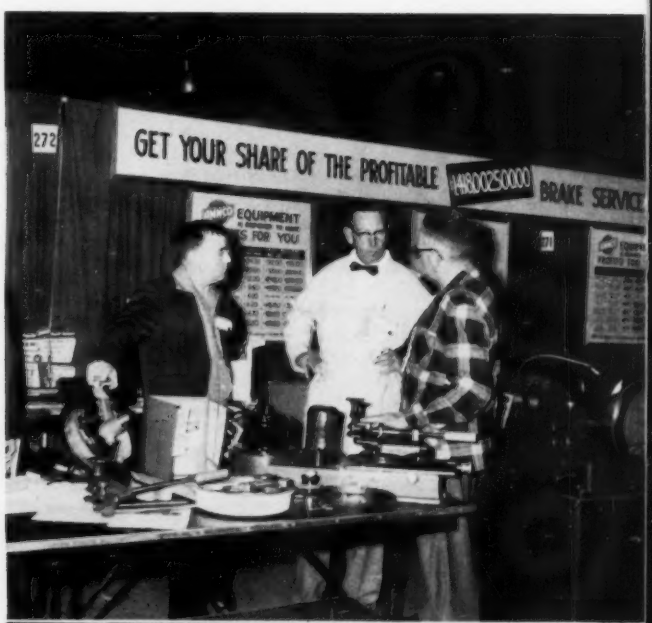
(For a partial camera tour of the 10th Pacific Automotive Show, see the illustrations below and on Pages 32 and 33).

Whether looking at leisure or listening to a demonstrator, automotive service specialists displayed keen interest in products and practices throughout the action-packed show days.

Record Pacific Automotive Show

cont'd

Pilot model of speedy, low cost tote car—here taking a demonstration run down the aisle—bowed-in at one show booth.



There was many an informal technical session on the spot (such as that above); and demonstrations were very much the order of the day, every day (below, and at the right).

Crowd-pleaser novelties included not-so-dumb dummy at left, which attracted willing signatories for the mailing list.

Chicken at right, trained to hit "home runs" for payoffs in feed, proved a popular as well as practiced public performer.

NOTHING INTERESTING WENT UNSEEN BY THESE VISITORS

Does it pay to farm jobs out?

Part seven of a series of articles on shop management . . . designed to bring ASD readers the time-proved procedures of profitable service shops throughout the country

Many shops profit by replacing complete units—others find they lose money in doing so. Only a careful study of your own service facilities will show which is more profitable for your shop

By ED PACKER

● IT'S NOT ALWAYS easy to come to the right answer on the question of which jobs to farm out and which to do in your own shop.

The final answer must be influenced by the space that you have available for rebuilding, the manpower that you can employ for this specialized work, and the amount of money available for specialized equipment and parts inventory.

We are not trying to arrive at an answer for you. But it does seem important to point out that many a shop has found the necessary space by nothing more than a good, thorough job of housecleaning. The manpower became available by extending the working day of a few employees who wanted to make a little more money. And the cost of the equipment and parts for rebuilding—that is the interest for the money invested—was trifling compared to the profits that resulted.

Many a shop owner has told the writer that there is no investment on earth that is quite so profitable as money put into good shop equipment.

LEAKY RADIATORS A "HEADACHE"

One of these men has a small but busy shop located in a farming community in central Illinois. Leaky radiators on customers' cars had been a "headache" to him, and every radiator had to be sent to a specialist. The shop owner would have to remove the radiator, drive over to the specialist's shop and after a wait of a few hours, or perhaps a few days, go back again and get the radiator and then install it on the car. Generally the job was excellent, but the profits hardly paid for the delivery and pick-up costs.

When a repaired radiator did fail the radiator specialist would do the job over, but there was always the loss in having to remove the radiator, and take it over to the other shop, pick it up and replace it again. It was a bad situation; and to make it worse, customers would refer to the "monkey wrench" mechanics — implying that their specialty was just removing and replacing parts, not doing a complete service job.

But this shop owner was not the kind to take this "lying down." In a space no larger than that required for two cars, this shop owner put in the equipment needed for testing, cleaning, and repairing radiators. It wasn't the profit that he was after. He just wanted to "get off the hook" on his customers' jibes, and wanted to have some control over the quality of each job that went through his place.

We didn't see the shop for almost another year, and on the next visit we wondered if we were in the right place. While this was still a good general repair shop, it had more the appearance of a specialized radiator repair shop. Not only was the owner

A modern radiator department requires little more space than would be taken by a car or two.

Since carburetor service begins and ends with the shop mechanic, many shops elect to do the rebuilding also.

A distributor tester is the key piece of equipment in modern tune-up, as well as in distributor rebuilding.

servicing radiators on the cars of his own customers, but he was doing a big volume of radiator work for local trucking concerns and for tractor dealers in the vicinity. Without really meaning to do so, *he had become the specialist*, and folks were coming to him.

Fuel pumps stacked up for rebuilding when the time permits.

SKILLED LABOR GOING TO WASTE

One shop operator we heard of allowed his engine overhaul equipment to gather dust for some years. He had found that rebuilt units sold well, could be exchanged simply with the rebuilder and his mechanics were well paid for the installation. This situation was fine until his seasonal recap of unapplied time gave him quite a jolt. He then shrewdly deduced that *he was buying skilled labor from the rebuilder while skilled labor was going to waste in his own shop.*

His answer to this problem was simple enough. He still installs rebuilt engines, since many of his customers have shown preference for the 1-day service it allows; but, he rebuilds a good many of them himself. The only sublet labor on his jobs now are the crankshaft grinding—his own labor pool supplies the reboring, valve grinding, cleaning and assembly operations. His profit in overhauls done in spare time is naturally not as high as if he kept a production-type assembly line working, for he must pull mechanics from this work whenever a customer drives in for a job. But he does have a small profit showing for this spare time work, whereas it was net loss when allowed to fall into the "unapplied time" column.

He found that spare time could be boxed up and held on the shelf for later sale, when put into a rebuilt unit. But spare time that was allowed to be wasted was long gone—with no hope for recovery. Time is a highly perishable commodity—you've got to make the most of it while it's fresh.

WHY NOT HANDLE THE WHOLE JOB?

Now let's consider something small —something that can be handled right on a good mechanic's work bench with an investment in specialized tools and a stock of parts that would take up no more space than a suitcase—*carburetor rebuilding.*

First and last you handle the job: You take the carburetor off in the first place, and you put the exchange carburetor back on. In between, you'll probably play it safe by double checking the rebuilt unit—so why not do the whole job, and keep the whole profit?

And what has been said about carburetors applies very well to fuel pumps. Many manufacturers supply brand new units and reconditioned assemblies, as well as complete rebuilding kits for those who wish to handle the whole operation. So take your choice.

Far off the beaten path in a mountain community catering to tourists we saw a really amazing accumulation of carburetors and fuel pumps fairly oozing out from an otherwise orderly bench.

"What gives?" we asked.

"Right now we're selling mostly new units, exchanging a few for rebuilds, and stacking up anything the customers don't take with them for rebuilding when we have the time," the shop owner told us.

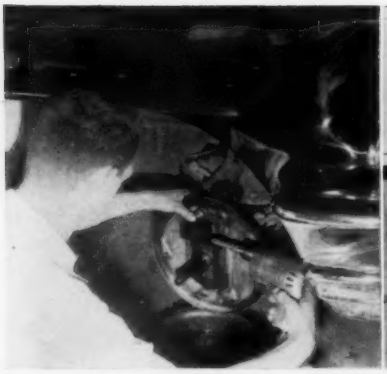
FAST SERVICE MAIN OBJECTIVE

Maybe that's the answer to what to farm out and when to farm it out. If you're caught short for parts, then don't hesitate on the farming out angle. Get the needed parts, new or rebuilt, from your jobber, and get the customer out of your shop as quickly as possible. You'll keep him happy, and the shop will profit from giving such prompt service.

We found out later that this shop owner would have very little to do other than rebuild units during the Winter months.

So perhaps the answer to your question as to whether you should farm out units or not is influenced not alone

(Continued on following page)



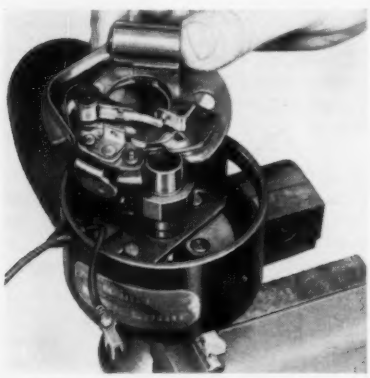
Renewing a wheel cylinder by honing the bore and installing new cups and pistons.

Relining brake shoes in the shop, using drilled linings for speed and precision.

Management . . . CONTINUED

by space available. manpower or the investment, but by geography — the kind of geography that makes it impossible for motorists to get to you during certain months of the year.

The foregoing is an extreme situation, of course. Less extreme, in fact quite common, is the situation where shops are very busy some days of the week or some weeks of the month and much less busy, if not actually idle, at other times. The rebuilding of units such as carburetors and fuel pumps as a means of keeping good



Distributor rebuilding is speeded up by replacing the entire breaker assembly as a unit, which also insures correct alignment and proper relationship of the parts.

mechanics profitably employed is more important than the direct profit. Certainly no mechanic who is worthy of the name is going to stand by and twirl his thumbs. And no shop owner can long afford to pay wages unless profitable jobs are handled.

So on parts that can be stacked up during the rush periods and rebuilt in what would otherwise be slack time, the advantages are great.

For a number of years now the increase of compression in engines has put new demands on distributors. Today there is no such thing as "good enough" in ignition timing. And if there is shiver and shake in the distributor shaft, you're going to have a rough and nervous engine no matter how precisely you time the distributor.

POINT REPLACEMENT BIG BUSINESS

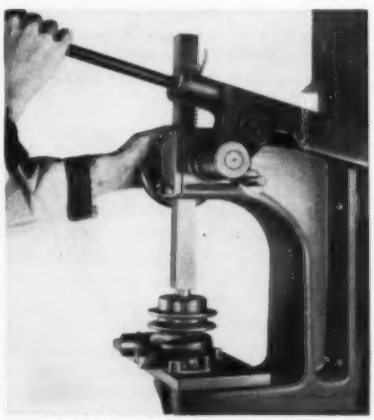
The distributor tester, therefore, has become a common sight in all first-class shops, and the replacing of points in distributors ranks high on the list of service jobs. Today, however, we have readily available breaker plate assemblies and prealigned points, so relatively few shops find it pays them to rebuild distributors. Most shops, however, would require little more than a bushing driver tool in order to complete the "rebuilding" set-up. So when you're that close to having "the works," why not check on this distributor situation. If you're rushed, then by all means sell the customer a new distributor or one that has been factory rebuilt. But where time permits, then build your reputation and boost you profits by whacking out the old bushings, driving in the new, reassembling the unit, and checking it on the distributor tester.

You might also extend yourself only for the drivers, refacers, and such tools used in rebuilding water pumps. Most shops have an arbor press, and it takes but little more to put yourself in the water pump rebuilding business. True, some of these pumps offer complications and hazards that make it smart to install new or factory rebuilt units. But where the rebuilding job is just a case of replacing seals and refacing a rough surface or two, then it would seem that the customer is entitled to this advantage, and you are entitled to the profit from such a job.

On occasion you may have "mixed emotions" on what to do. "Mixed emotions" were defined by one mechanic as "that feeling that comes over you when you see your mother-in-law backing your brand new Cadillac off a high cliff."

There are two schools of thought—radically opposed—on the subject of rebuilding starters, generators, and regulators. Some mechanics wouldn't touch an electric job "with a 10-foot pole"; others have found electrical work to be a "gold mine."

Those who are profiting by electrical work are for the most part cashing in on the wonderfully practical service instruction being given by manufacturers of electrical testing equipment. There's no law that says you shouldn't exchange starters, generators, and regulators for rebuilt units. But the law of economics is proving daily that there are few service operations more profitable than



An arbor press is the most expensive part of the water pump rebuilding equipment —and already on hand in most shops.

electrical jobs. This is due in part to the unjustifiable mystery surrounding electrical illls—and, pardon the pun, **there's gold in them there 'ills.**

As car performance goes up, so also does the need for really good brakes. And while it is true today, as it always has been, that a good mechanic can reline a set of brake shoes, there are many who have found it better to exchange them.

Here it's not a case of servicing one carburetor, one fuel pump, or one something else. Instead it is generally eight none-too-clean shoes. Old shoes that need relining can be about as filthy as anything we know. Naturally any shop that expects to hold good mechanics and turn out good jobs is going to have an A-1 cleaning tank. But many mechanics still like the idea of exchanging shoes, especially when

they are not only relined but realigned.

The ability to service shoes on a mass-production basis gives the shop owner something to think about seriously when considering doing this kind of work in his own place. But as with other farming-out problems, a compromise on the brake shoe problem is often the answer.

With a moderate stock of drilled lining sets and a few lined shoes for immediate replacement on the more popular cars, the shop owner then relies on his jobber when faced with an emergency. And the emergency could range all the way from some ancient chariot (that still needs brakes) to a series of rush jobs that suddenly uses up all the stock on the shop owner's shelves.

A TYPICAL EXAMPLE

While on the subject of brakes, one of the illustrations shows a typical example of what can and does come up from time to time. The wheel cylinders are leaking, but a close examination shows that the condition of the wheel cylinder is such that honing it and installing new pistons and cups will put it in like-new condition without removing it from the car. Of course, should the cylinder be too badly scored, so as to make rebuilding inadvisable, the installation of a new wheel cylinder assembly is the only answer.

So to settle the question of which jobs should be farmed out from your shop, perhaps a compromise today will bring the right answer tomorrow. Feeling your way along by rebuilding some units that require but little equipment for rebuilding, and some farming out, will give you the right answer for your particular set-up.

And don't forget that many a man who has put in radiator repair equipment, a brake drum turning lathe, front-end system aligning fixtures or frame straightening equipment, has found that *he has become the specialist to whom others come from a wide service area.*

Willys FC Hard to Shift? Check Control Housing

Should difficult shifting be encountered on Willy's Forward Control models, the factory suggests that a check be made for looseness of the bolt and nut through the remote control lever housing, which is bolted to the floor pan.

Tighten this bolt and test the shift mechanism *before* adjusting the shift rods. Tighten this bolt periodically to prevent the possibility of its coming loose and causing difficult shifting.

MARK IV

AUTOMOTIVE AIR CONDITIONING

the **nationally** advertised,
nationally distributed,
nationally serviced brand –
pays profits
in every part of the country
. . . as far north as Boston,
as high as 5,000-ft. Denver.

Over 200 *new* distributors
joined Mark IV this year.

Over 530 distributors and service
centers in 294 cities offer
trained, factory authorized service.

Join this profitable group. Plan for next
year now. Write or wire today.

John E. Mitchell Co.
3800 Commerce St.
Dallas, Texas
I'd like information about a Mark IV distributorship or dealership.
Name_____
Company Name_____
City_____ State_____
Type of business_____
We are ☐, are not ☐ rated in Dun & Bradstreet.

MARK IV DIVISION
JOHN E. MITCHELL COMPANY
3800 COMMERCE STREET DALLAS, TEXAS

Manufacturers of Fine Machinery for More Than Half a Century

By GUY F. WETZEL
Technical Editor

Trouble shooting the charging system

There is nothing mysterious or unusually difficult about this work when mechanics follow a given line of procedure, acquire the necessary knowledge, and understand the specific instructions supplied by the various makers of test equipment.

• THE CHARGING SYSTEM is one of the most important of the several auxiliary systems that permit the automotive engine to function. If all the components of the system are in reasonably good order, there will be an adequate supply of electricity for operating the cranking motor, the ignition system, lights, radio, heating fan, electric windshield wiper, stop lights, turn signals, automatic window regulators, and automatic seat adjusters.

NUMBER OF USES SURPRISING

On some cars, in addition to the foregoing, electricity is required for operation of the push button gear selector on automatic transmissions, and in connection with overdrive control where the conventional transmission with overdrive is used. Rather surprising, isn't it, when you stop to consider the number of places on a car where electricity is used in addition to starting, ignition, and lights.

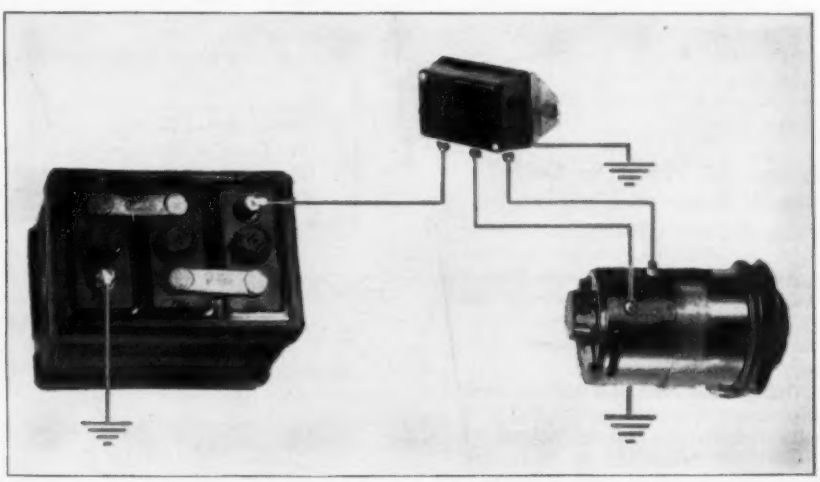
THREE BASIC UNITS

The charging system consists of the generator, generator control or regulator, battery, and the necessary wiring. It is logical to include the battery in the charging system, considering that this system is the source of electricity for the engine and all of the accessories and appliances that depend on electricity for their operation, whether or not the engine is running.

Another consideration is the close relationship between the battery state of charge, the action of the generator regulator, and the amount of generator output. The generator regulator is controlled closely by the battery charge condition.

The complaints made by customers, which could be due to defects or failure in the charging system, are usually one or more of the following: (1) dead battery, (2) battery won't stay charged, (3) battery needs water frequently, (4) starter turns engine over too slowly, (5) lights flare up when engine is speeded up, (6) generator does not charge, (7) charging rate is high all the time.

The first four of these complaints could be due to faults in the battery, the regulator, or the generator. The fifth complaint—lights flare up when engine is speeded up—is generally due to the fact that the generator voltage (1 to 1½ volts on 6-volt systems, or 2 to 2½ volts on 12-volt systems) is higher than battery voltage, and when the generator picks up the lighting load from the battery, the higher voltage will make the lights brighter. This is perfectly normal, though if the battery is at lower than normal charge and the generator charging voltage is higher than it should be, the differ-



The charging system consists of the battery, regulator and generator—each unit dependent on the other two for maintaining top performance in the electrical system.

ence in the brightness of the headlights will be more noticeable and objectionable, and should be corrected as far as practicable by charging the battery and reducing the charging voltage.

When there is trouble in the charging system (including the battery), the first thing to do is to determine whether it is the battery, the generator, the generator regulator, or the wiring. In order to follow a logical procedure, we will take up the different units in the charging system one at a time and consider the troubles that may occur at each.

BATTERY

The only really "good" battery is a fully charged battery. This is true because the action of the generator-regulator is designed for operation with a fully charged battery, and the reservoir of power that is frequently needed can only be gotten from a fully charged battery. A substantial proportion of charging system troubles are due to batteries that are only half or less than half charged.

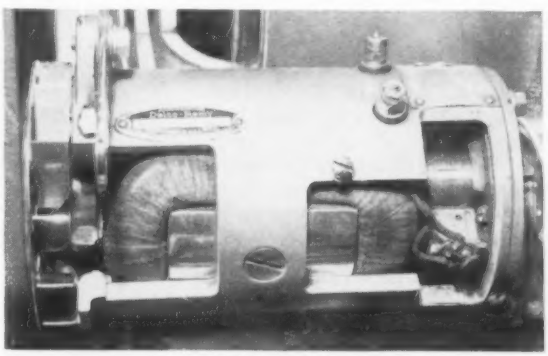
The function of the charging system is to *maintain* battery charge by replacing the current that is used for starting, ignition, lights and other electrically operated equipment. It is *not* designed to charge batteries that are partly or fully *discharged*. Under conditions of continuous use for long periods, such as using the car for a long trip and driving all day for several days, a partly charged battery may become fully charged. But under average driving conditions, the battery will usually just maintain its state of charge, whether partly or fully charged, or reduce its charge gradually, where driving mileage is limited, or where there are short drives with numerous cold starts.

MAKE THESE THREE TESTS

There are three tests which should be made to indicate the actual condition of a battery: (1) specific gravity, (2) quick discharge (break down) test, and (3) open circuit voltage test.

The gravity test will give a good idea of the state of charge, though it does not tell much about plate condition or capacity. It will indicate approaching battery failure if there is a difference in cell readings of 25 "points" (0.025) or more. Be sure to allow for the temperature of the electrolyte if it is more than 5°F. above or below 80°F., as the expansion or contraction due to temperature deviations from the reference temperature will make a noticeable difference in the true gravity as compared with the indicated gravity. To make the correction, *subtract* 4 "points" of gravity for each 10°F. *below* 80°F. *and add* 4 "points" for each 10°F. *above* 80°F. Thus for electrolyte at 30°F., which is 50° below 80°F., subtract 20 "points" of gravity from the hydrometer reading. Hydrometers are available with built-in thermometers so that the correction, if any is needed, is indicated.

The hydrometer is an important tool for checking batteries. It is preferable to use a hydrometer with built-in thermometer to readily get the amount of correction for temperatures above or below 80°F. Inset: Chart showing the number of "points" of gravity to be added to the indicated reading of the hydrometer for temperatures above 80°F, or subtracted for temperatures below 80°F. This amounts to 4 "points" for each 10°.



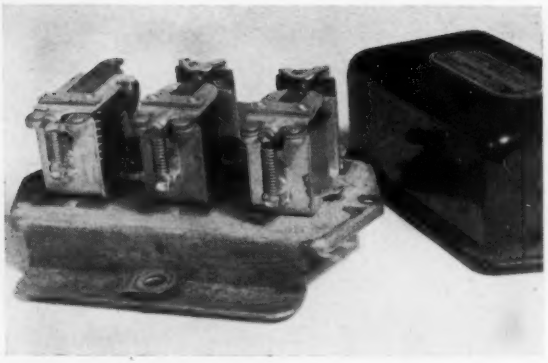
Cutaway model of a generator showing the field windings, commutator and output and field terminals.

A quick test of capacity can be made, where gravity is up where it should be, by running the cranking motor for 15 seconds with ignition coil grounded or coil secondary wire disconnected. With a voltmeter connected across the battery, note the voltage when the cranking motor has been operating for 15 seconds, with a warm engine. The drop in voltage at the end of the 15 second period should not be over 1 volt on 6-volt systems or 2 volts on 12-volt systems.

A more positive test of battery capacity is made by connecting the battery to a carbon pile rheostat and applying a load in amperes equal to three times the ampere-hour rating of the battery, for 15 seconds. The battery voltage drop should not be over 1½ volts on a 6-volt system or 3 volts on a 12-volt system. If the battery is not sufficiently charged to make this test, try fast charging at 80 amperes (6-volt system) or 40 amperes (12-volt system) for three minutes. If the battery will accept this charge without exceeding 7.5 or 15 volts, respectively for 6-volt and 12-volt systems, you can assume that its capacity is satisfactory.

The open circuit voltage test will quickly indicate differences in cell voltages, where the cell connecting straps are exposed or can be contacted through the battery compound. The open circuit voltage tester is a sensitive voltmeter which will read to one

(Continued on following page)



Typical generator control or regulator. At left is the cut-out relay, center is the current control or limiter, and right is voltage control or limiter. The lower spring hanger, which is plainly shown, is bent to adjust.

Trouble Shooting . . . CONTINUED

hundredth volt (.01) on a scale calibrated to read in both volts and percent of charge. On the dial of one OCV tester, zero charge is shown as 1.95 volts, 25% is 2.0 volts, 50% is 2.044 volts, 75% is 2.085 volts, and 100% is 2.14 volts. The scale (from 1.90 to 2.1 volts) is greatly expanded so that very accurate readings can be obtained in the range of battery cell voltage. The entire scale on this instrument runs from 1.4 to 2.8 so that voltages of cells under charge can be checked also.

DRY CHARGED BATTERIES

A word of caution in regard to dry charged batteries will be in order at this time. Ordinarily it is assumed that these batteries are ready to give service as 100% fully charged units as soon as they are activated by pouring in the electrolyte. Actually, however, they will have only 40% to 60% of full charge until they have been cycled several times, and, depending on the setting of the voltage regulator, may never come up to full charge unless they are charged fully from an outside source. This is especially true if the dry plates and separators have absorbed any moisture. This can be checked by testing across the battery terminals with a voltmeter. If any voltage at all is indicated in the dry state, the electrolyte should be put in at once and the battery put on charge to bring it up to full charge.

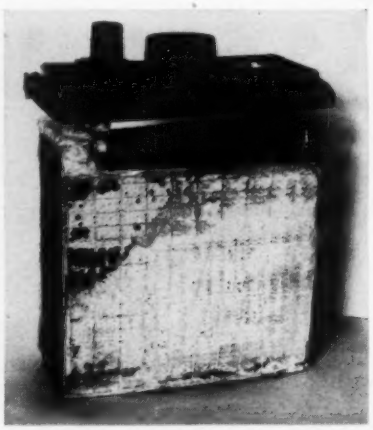
Sulphated batteries can usually be spotted by low capacity and high resistance to current from a fast charger. If sulphation is suspected, apply the fast charger. If 80 amperes for a 6-volt or 40 amps for a 12-volt battery cannot be put through the battery at 7.5 volts and 15 volts respectively for 6 and 12-volt batteries, the battery is sulphated.

One bad cell out of three in a 6-volt or one out of six in a 12-volt battery will ruin the whole battery as far as using it is concerned. Repairing it will ordinarily cost almost as much as a new one, and therefore there is only one thing to do—replace it.

GENERATOR

The generator, having movable parts, is subject to both mechanical and electrical troubles. Actually the generator is a finely built machine and seldom gives trouble. But being a machine, it will show wear and deterioration after long periods of service, and in some cases accident, breakage or abuse will put it out of service. The wear will show up on the commutator and brushes, and possibly in the bearings. Most of the generators have a plain bearing at the commutator end and a ball bearing at the pulley end.

On some generators, the inner race of the ball bearing is a relatively loose fit on the armature shaft, and is prevented from rotating on the shaft by tightening the pulley retaining nut. If this nut has not been properly tightened or has worked loose, the inner ball race will allow the armature shaft to turn in it, which will wear a groove in the shaft. This will allow the armature to rub against the pole shoes and ruin the generator unless the condition is caught in time. The correction will require a new armature and new pulley-end bearing.

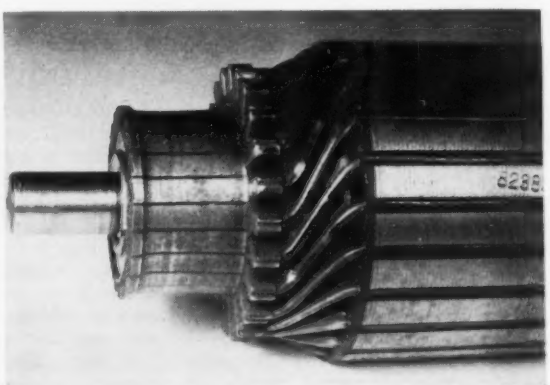


Showing how badly sulphated battery plates appear. When plates are as bad as this it is practically impossible to recharge the plates or get the battery in usable condition.

CONDITIONING THE COMMUTATOR

Trouble at the commutator will show up in two ways: (1) dirt, oil, grease or pitting, and (2) wear. Dirt, oil, or grease usually comes from over-oiling the commutator-end bearing. This will build up an insulating layer on the commutator and either reduce or interrupt current flow so the generator will not put out current as it should. The remedy is to clean the commutator, which can be done by using fine sand paper of 000 grade or 240 grit wet-or-dry abrasive paper. Pitting or roughness may be due to sparking or excessive current output, and if not too bad, may be cleaned up with sandpaper.

Wear will result in cutting a groove around the periphery of the commutator. This can only be corrected by turning down and undercutting the commutator. Wear on the brushes will shorten them to the point where they will not properly contact the commutator. New brushes will correct this difficulty.



Excessively worn commutator. This happens to be a starting motor armature, but the same wear pattern appears on worn generator commutators.

When the complaint comes in that the battery is run down, and by testing it is found that the battery is not at fault, the next step is to make a quick check to see whether it is the generator or regulator that is the trouble cause.

The generator can be checked for its ability to put out current by grounding the field terminal on the generator, thus by-passing the regulator, and running the engine at moderate speed (1000-1500 rpm) on all but Ford products. If the car is equipped with an ammeter on the instrument panel, it will indicate whether or not the generator is charging. If there is no ammeter, insert one in the armature circuit by disconnecting the wire from the A or G terminal on the regulator and connecting the ammeter leads to the regulator terminal and end of the wire which was disconnected from the terminal. Be sure that the ammeter is connected so its polarity is correct and it will read upscale.

Speed the engine up enough to see that the generator will put out 35 to 50 amperes (6-volt) or 20 to 35 amperes (12-volt). Do not allow the generator to go over these values or it may burn out the armature, or damage the distributor contact points, since the voltage will be unregulated. If there is current output the generator is good. If not, the generator is at fault. On Ford products, jump from A to F terminals to check the generator.

POLARIZING

If the generator is at fault, it should be polarized before removing it for servicing or replacement. A generator that is not correctly polarized will not put out current properly even though it is otherwise in good condition. A generator can be polarized in the wrong direction when disconnections and reconnections have been made in the charging system, if there is a poor ground at the regulator, or if the battery has been put in backwards even temporarily.

To polarize a generator, on all ex-

(Continued on following page)

Charging System Troubles—Causes and Cures

BATTERY

Symptom	Cause	Correction
Low charge	Low water	Add water
	Too low VR setting	Adjust VR
	Battery in poor condition	Replace battery
	Excessive use of starter	Charge battery, Increase controlled voltage
Low capacity	Low water	Add water
	Sulphated plates	Slow charge and cycle
	Lost active material	Replace battery
	Oxidized grids	Replace battery
Dead battery	Internal shorts	Replace battery
	Broken connectors	Replace battery
	Ignition or other appliance left on closed switch	Recharge battery
	Cracked battery case	Replace battery
Overcharged battery	Too high VR setting	Adjust VR. Replace battery if capacity seriously reduced
Corroded terminals	Neglect	Clean terminals and apply vaseline
	Charging at too-high rate	Wash with baking soda solution
	Acid leaks	Correct if possible
Excessive water use	Too high VR setting	Adjust VR
Corroded hold-down	Acid on top of battery	Clean and paint, or replace
Broken hold-down	Acid corrosion	Replace
Lights flare	Low charge	Recharge

WIRING

Symptom	Cause	Correction
No charge	Poor connection	Tighten, clean
	Broken conductor	Replace conductor
	Burned out charge signal bulb	Replace bulb
Discharged battery	Worn insulation allowing short to ground	Insulate or replace
Low battery	High resistance in wiring or connections	Locate excessive voltage drop and eliminate

GENERATOR

Symptom	Cause	Correction
No charge	Defective VR	Clean/adjust VR points or replace
	Dirty commutator	Clean commutator, turn if necessary
	Worn commutator	Turn and undercut
	Worn or broken brushes	Replace brushes
	Broken brush or field lead	Replace
	No field ground	Provide ground
	Defective armature	Replace
	Open or grounded field	Replace field windings
	Reversed polarity	Polarize
	Worn bearings	Replace bearings (and armature if shaft is worn)
	Loose belt	Tighten
Overheating	Excessive current	Adjust CR
Excessive noise	Squeal from loose belt	Tighten belt
	Worn bearings	Replace bearings
	Loose or missing mounting bolts	Tighten or replace

REGULATOR

Symptom	Cause	Correction
No charge	Dirty, pitted contacts (no field current)	Clean contacts or replace generator regulator
	Poor regulator grd.	Correct ground condition
Low charging voltage	Low spring tension on VR	Increase spring tension
	Loose connection	Clean/tighten
Too high charging voltage	High spring tension on VR	Decrease spring tension
Excessive current	Low spring tension on CR	Reduce spring tension
Excessive water required by battery	Too high VR setting	Adjust VR
Intermittent charging	Broken or open resistor	Replace resistor or regulator
Battery discharged	Stuck cut-out relay contact points	Clean points. Check battery polarity

Trouble Shooting . . . CONTINUED

cept Ford products, jump momentarily from the A (or G) terminal to the B terminal on the regulator. This will send a surge of current through the generator which will properly magnetize the armature and field. On Ford products, which use the so-called heavy duty or B circuit hook up, jump from the B to the F regulator terminal.

If the generator still does not put out, it is defective and must be removed and either serviced or replaced. Usually it is cheaper to service it than to replace it, and the shop has a labor sale.

After removing the generator from the car, remove the end plate at the commutator end. If inspection of the brushes and commutator does not reveal the reason for the failure, several other tests should be made on (1) end plate, (2) armature, and (3) field circuit.

TESTING THE GENERATOR

For making these tests the growler and test light should be used. On the end plate the test light is used to check the insulated brush to see that it is not grounded.

The armature should be tested for (1) grounds, (2) shorted coils, (3) open coils. Touch one prod of the test light to the armature shaft or laminations and the other prod to the commutator. If the lamp lights, the armature is grounded and defective. Open coils are tested in a similar way. With one test prod held against one commutator segment, touch each other segment with the other test prod. The test lamp should light for each segment. If it does not, one or more coils are open. Visual inspection of the joints of wires at the commutator flange will often pick out poor or loose connections.

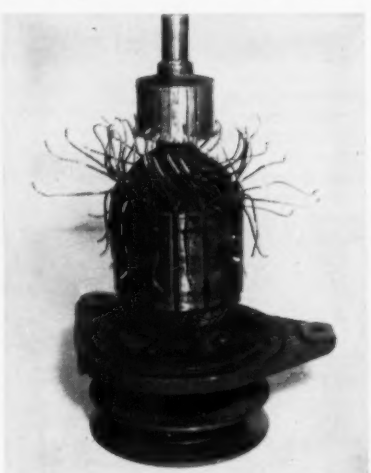
Shorted coils are tested with the growler. With current turned on the growler windings, and the armature in position in the "V," slowly rotate the armature, with a steel hacksaw blade or other thin steel blade held parallel to the armature slots. The blade will be attracted and will vibrate at any shorted coils. Unless the defective insulation can be spotted and reinsulated the armature is defective and must be replaced.

The field circuit in the generator should be tested for continuity and grounds. On all except Ford products the generator field circuit gets its current from the insulated brush and is grounded through the regulator. Therefore the circuit can be tested for continuity by touching one test prod to the insulated brush or end of the field lead if disconnected from the brush, and the other prod to field terminal on generator. If the lamp lights, the circuit is unbroken. Grounds in the field circuit are checked by touching one prod to either end of the field circuit and the other prod to the generator frame. If the lamp lights the field windings are grounded and must be replaced unless the point where the ground contact happens to be, can be located and insulated.

After the correction of defects or replacement of parts, the generator, properly polarized, should work and put out the normal amount of current. If a generator test bench is available it is advisable to check the generator for operation in accordance with specifications. Otherwise put the generator back on the engine, polarize it, and it should put out current. Be sure the belt is correctly tightened. There should be not over 1" deflection in the longest span between pulleys with a 5 pound force applied to the belt. Be sure all wire connections are clean and tight.

Using the growler to test an armature for shorts. The steel blade will be attracted and vibrate at the slot or slots where there are shorted coils.

Testing the field windings for continuity and grounds. Touching the prods to the ends of the field leads will light lamp if there are no breaks. Touching one field lead and generator frame will light lamp if there are any unwanted grounds.



An armature that became overheated due to excessive current, melted the solder holding the wire ends to the commutator flange. Centrifugal force did the rest.

REGULATOR

The generator control, generator regulator, or voltage regulator, as it is variously called, has three units—cut-out relay, voltage regulator or voltage limiter, and current regulator or current limiter.

The cut-out relay acts as a one-way check valve to allow current to flow from the generator to the battery but to prevent reverse current flow from the battery to the generator. The contact points on the cut-out relay should close at a voltage slightly above battery voltage and open at slightly below battery voltage when the reverse current from the battery energizes the current coil; which, in turn, neutralizes the magnetic effect of the voltage coil and the spring pulls the points apart. The reverse current is usually given in amperes. The cut-out relay seldom gives trouble or requires adjustment.

Once in a while the points may stick

together and allow the battery to discharge through the generator when the engine is not running, or when it is running at lower than minimum generating speed. If and when this occurs it will result in a discharged battery. It is easily checked by removing the regulator cover and visually inspecting the contact points. The points ordinarily can be forced apart and cleaned by using fine sandpaper or Flexstone. Wrong battery polarity will sometimes make the cut-out relay armature flutter and then cause the points to stick.

POINTS VIBRATE CONTINUOUSLY

The voltage regulator is in operation much more of the time during engine operation than is the current regulator, and when in use the points vibrate continuously except when the electrical load is heavy enough to lower generator voltage below the control setting. A low battery will also lower the voltage due to lower CEMF (counter electromotive force) or opposing battery voltage, so the voltage regulator will not be operating at this time.

The current regulator limits the current from the generator to the amount for which it is set, but the contact points do not vibrate. They merely open, then close when the load drops off.

The troubles to which the generator control is subject are burned or dirty contact points, wrong adjustment, and occasionally a broken wire, poor internal contact, or broken or burned out resistor. When the contact points are in poor condition or dirty, no field current will flow and there will be no generator output. The field current is generally under 2 amperes, and with the low voltage across the contact points it takes very little to interrupt the field current flow.

The remedy when this occurs is to clean the points by using a Flexstone or very fine grit (400) wet-or-dry abrasive paper, and then cleaning with lintless tape wetted with carbon tetrachloride and finally wiping with dry lintless tape. The abrasive must be moved in a direction parallel to the length of the vibrating arm or armature, never crosswise.

Occasionally the air gaps will change and these should be checked against factory specifications.

VERY SENSITIVE TO ADJUSTMENTS

The most common trouble with the voltage regulator or current regulator is wrong adjustment. The correct adjustment depends on the tension of the spring that controls the vibration of the armature and lower contact point. More tension on the spring means that it will take more magnetism to open the points, and therefore more voltage or current for the voltage limiter and current limiter, respectively. The adjustment of the spring tension is very sensitive, as a very slight change will make a big change in the voltage or the current. The tension is adjusted by turning a screw on most of the Delco-Remy regulators and by bending the spring hanger to which the lower end of the spring is attached on the other makes.

The voltage should be 6.9 to 7.4 on 6-volt systems and 13.8 to 14.8 on 12-volt systems. On Delco-Remy generator controls the regulators are set at an ambient temperature of 125°F. On these regulators, the ambient (surrounding) temperature is considered quite important, and for accurate adjusting at other temperatures, their temperature compensating tables should be consulted.

For practical quick checking of generator controlled voltage, if the battery is above 1.250 gravity, a close approximation can be obtained by connecting a voltmeter from the battery side of the ignition coil to ground on 6-volt systems, or from the battery side of the ignition system resistor on

(Continued on following page)

PROFIT . . .
BY OUR EXPERIENCE!
KAL-LITE
KAL-TACH
ASK YOUR JOBBER!
KAL-TUNEMASTER . . . the tune-up tools with the built-in know how. Actually create extra selling opportunities . . . extra profits. New free booklet tells how.
KAL-DWELL
KAL-SPARK
KAL-REG
WRITE FOR HELPFUL FREE BOOK, "PROFIT BY EXPERIENCE" . . . tells from actual experience how to turn common car "complaints" into sales of tune-up, replacement parts, service and accessories.
PROFIT BY EXPERIENCE
ASK FOR BOOKLET F-65-A
KAL-EQUIP COMPANY
BOX 567
KALAMAZOO, MICHIGAN

Trouble Shooting . . . CONTINUED

12-volt systems, to ground.

The engine and auxiliaries should be at normal operating temperature. Run the engine at 1500 rpm and observe the voltage. The voltage may climb as the test is being made, so watch until there is no further voltage increase and the system is stabilized. This reading will ordinarily be about 0.1 to 0.2 volt lower than the actual controlled voltage at the generator. Comparing this reading with one taken at the G or A terminal on the regulator will show the voltage drop through ignition switch and wiring.

If the voltage, as observed at the coil or resistor, is more than 0.3 volt below or 0.1 volt above the specified controlled voltage, the voltage regulator should be adjusted. Too high voltage may burn out light bulbs, shorten the life of distributor breaker points, and overcharge the battery. Batteries subjected to frequent overcharging will have shortened life and may be ruined due to oxidation of the grids in the battery plates, particularly the positives.

Too low controlled voltage will result in an undercharged battery, which will also shorten battery life due to sulphation on the battery plates. In addition, starting may be difficult and there is liable to be a dead battery at a most inconvenient time.

The adjustment of the voltage and current regulators is accomplished by bending the hanger or turning the adjusting screw to increase the spring tension to raise the voltage or maximum current, or to decrease the spring tension to decrease the voltage or maximum current, on the voltage regulator and current regulator, respectively.

WIRING

Wiring in the charging system is a possible source of trouble and must be considered. The troubles to be watched for are loose or corroded connections or terminals, chafed or defective insulation, breaks or partial breaks in the conductors, or where the wire ends are clamped by the terminals. It is essential that wherever there are grounded connections that these be connected to a good ground. Always be sure that there is a good connection between the car frame and the engine. Lights, radio, heating fan, etc., are grounded to the body and frame, while the generator and battery are grounded to the engine.

There should not be over .05 to .1 volt drop between the frame and the engine. This can be checked by connecting a voltmeter from frame to engine with the lights all turned on and engine running at above minimum generating speed. Also check the voltage drop from the base of the regulator to the engine.

Rerouting Hood Cable Cures Ignition Ills

Edsel reports that on some of the Ranger and Pacer series the hood release cable may contact the ignition resistor terminals. This can cause a short which would burn the insulation off the ignition wiring, prevent the engine from starting and/or intermittently ground out the ignition while driving.

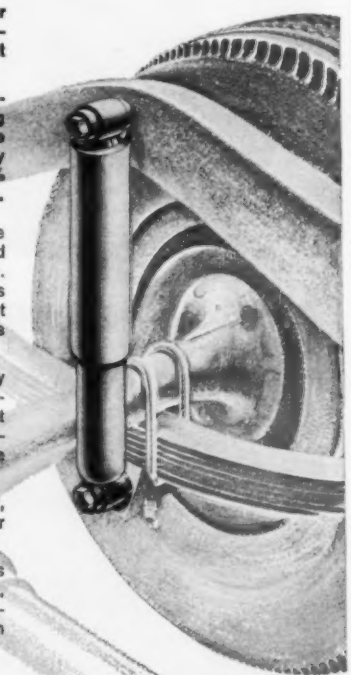
To eliminate this condition, it is recommended that the hood release cable be routed under the ignition resistor and through the clip provided at the wiper motor bracket left attaching bolt. In addition, the cable should be covered with electrician's tape or rubber tubing in the area of the ignition resistor.

BY DEMAND...FROM ENGLAND

ARMSTRONG Cushioned Ride SHOCK ABSORBERS

are now available to American car owners for an entirely new concept in quality riding—safest comfort and smoothest performance at all speeds.

AUTOMATIC COOLING, created by the exclusive circulating oil design, makes the big difference between an ordinary ride and the ARMSTRONG ride . . . another reason why ARMSTRONG is standard equipment on 80% of British built cars, and Continental cars too.



Remember, all shocks are not the same, some run hot and cause oil to thin out for decreased shock action at high speeds and on rough roads. But with Armstrong Cushioned Ride Shocks, less heat builds up—oil maintains its body and you get automatic cooling with a shock action that is steady at all loads, roads and speeds.

So sell "the ride of your life," sell the quality shock absorber—ARMSTRONG. Millions in service. No more in price. Armstrong offers the most complete line of shock absorbers in the world—chosen as original equipment by more automobile makers than any other.

Armstrong offers dealers a totally new product, an exclusive new "Double Action" Design, for greater replacement sales.

Armstrong offers jobbers greater sales and profits with the world's most complete line. American, British, European cars, trucks, buses and motorcycles . . . plus a QUALITY never before seen in this country.

ARMSTRONG Cushioned Ride SHOCK ABSORBERS

Write for complete details on this outstanding shock absorber at a competitive price for greater demand—greater profits for you.

MEMA

ARMSTRONG HYDRAULICS, INC.

564 E. ILLINOIS ST., CHICAGO 11, ILL.

202-A

help your HEART FUND help your HEART ®

Nearly every car that rolls off the assembly line does so on tubeless tires . . . and we're told that one replacement tire in every three sold is tubeless. So it's important to know about . . .

Servicing Tubeless Tires

By LYNE S. METCALFE

● THE ADVENT of tubeless tires for passenger cars and light trucks has presented many opportunities and also a number of problems in servicing. The greater efficiency of the tubeless tire has been well proven. However, the different techniques required in servicing them has made it imperative that the dealer have adequate equipment and tools to be able to make a fair profit on tire work and to build sales volume.

Let's see what we are faced with.

NEVER USE FORCE

In the first place tire mounting and de-mounting must be done without marring the air seals, bead or bead seat. For this reason an adequate tire changing machine has become essential. One that slips the bead over the rim with the least amount of friction or contact between bead and rim is most desirable. Because forcing tires is to be avoided at all times the beads should always be properly lubricated.

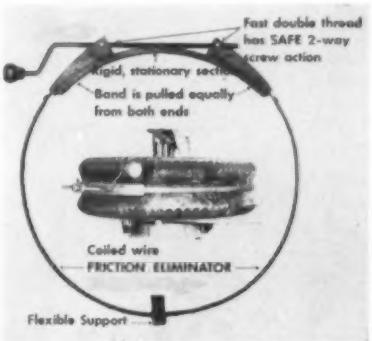
The adoption of the 14" wheel has made it even more imperative that an efficient tire changing machine be used because the smaller diameter tire is much more difficult to slip over the rim. Even an experienced tire man who can successfully mount and de-mount tubeless tires with hand tools on 15" and larger wheels will have difficulty on the smaller size.

BEAD EXPANDER EXPEDITES JOB

Even the apparently simple job of seating the beads presents some problems. Probably the most difficult beads to seat are those on the 14" hump type safety rims. Seating the beads is achieved by compressing the treads to force the beads out into the bead seats. A "bead expander" is needed that compresses the tire evenly around the circumference to seat the bead evenly.

A bead expander that fails to allow for slippage between it and the tire nearly always has a tendency to compress more on the side where the pressure is applied and this can result in a poor seat on the opposite side of the wheel.

Testing tubeless tires, which should always be done after mounting as well as to find punctures, can be done most efficiently in a tank that holds the tire upright and allows it to rotate freely. Suspending the mounted tire from the center instead of laying it down in a flat tank makes it easier to see the smallest leak and locate it accurately. This method also eliminates most of the heavy lifting and handling which requires much more effort and time.


Fast double thread has SAFE 2-way screw action
Rigid, stationary section
Band is pulled equally from both ends
Coiled wire FRICTION ELIMINATOR
Flexible Support

Anti-friction type bead expander which compresses the tire evenly to force the beads into their seats so that the tire can be inflated.

All tires should be checked carefully for slow leaks in air seals, valve and wheel rivets.

After a leak has been located and marked, the first step is to break the bead. Here again it is necessary to have proper equipment. Avoid pounding which can distort or dent the rim or damage the air seals. Tire irons should be used with extreme caution to avoid damage to air seals or the liners in some types of premium tires.

SMALLER WHEELS REAL PROBLEM

Breaking the beads on 14" wheels is especially difficult because the small diameter makes them extremely tight. Add to this the problems of forcing the bead over the hump on safety rims plus the soft sidewalls of nylon and rayon tires and you have a job that produces plenty of sweating and swearing if you don't have the proper tools.

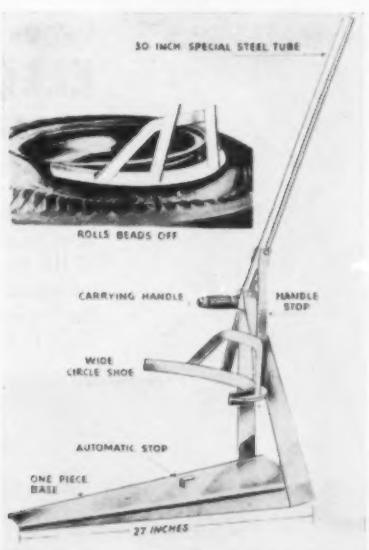
Some tire changers have built-on bead breakers. Of these some break one bead at a time, making it necessary to turn the wheel over, and others have double bead breakers of various types. An efficient type is the built-on double bead breaker that breaks both beads in one operation.

The breaking action also should be

(Continued on following page)

This power type tire changer with a built-on double bead breaker handles wheels and rims from 12" up to and including 17½".

Floor model type of bead breaker. A hammer should not be used in demounting a tubeless tire as damage is sure to occur.



carefully considered, since it is desirable to roll the bead off instead of simply pushing it off. Less pressure is needed and the danger of damaging the bead or air seal due to a frozen bead is minimized. Wide bead breaker shoes that break the beads far enough to drop them into the wheel well or drop-center are an advantage.

If the tire changer being used has no bead breaker, there are separate bead breakers available. A properly working one rolls the bead off with the same action previously described. In an interview with Walter A. Bishman, of the Bishman Mfg. Co., which has done much research in the tire service field, Mr. Bishman told this writer:

"The past three years have seen more changes in tires and wheels than there were for many preceding years. The first radical change was the tubeless tire followed by the adoption of the 14" wheel on most passenger cars for 1957. Furthermore, the trend to smaller wheels will probably continue as the car manufacturers try to satisfy the public demand for lower silhouettes.

"All of these changes have required improved methods of tire service. During the first couple of years that the tubeless tire was in general use many of them wound up with tubes in them, simply through mishandling that resulted from a lack of understanding on the part of the service man. Today, the service man is generally familiar with the techniques required in handling tubeless tires and aware of the fact that efficient equip-

Testing tubeless tires can be done in a tank that holds the tire upright and allows it to rotate freely. Even small leaks are readily located.

profitable POWER

unequaled Ingersoll-Rand quality

. . . only $94.50

½" DRIVE
ELECTRIC
SIZE 4U-SD

Cut 90% from nut running time with this powerful electric Impactool that makes the toughest jobs easy. Drill, ream, tap, saw holes, drill masonry—in fact, do any of 11 multi-purpose jobs with this one amazing tool. Ask your I-R Jobber how the low-cost, multi-purpose 4U-SD will add 25% to your service capacity.

18-741

ONLY INGERSOLL-RAND GIVES YOU
5 SIZES IN ELECTRIC IMPACTOOLS
8 SIZES IN AIR TOOLS

ment will save him time and money.

"The adoption of the 14" wheel on cars further complicated the situation.

"New developments on wheels and tires are continuing. Much of the tire service equipment built three years ago has become obsolete today and the same thing could happen to today's equipment. For instance, should a 13" wheel be adopted it probably would not have a center disc. In this case a tire changer that holds the wheel by the center hole would immediately become obsolete. This is just one possible change that illustrates the need to look at any piece of tire service equipment with an eye to the future when purchasing. It pays to select equipment that is simple to operate and requires the least physical effort in view of the labor turn-over problem and the necessary training of new men."

There are several methods of making tire repairs. Small punctures can be repaired with cold plugs without removing the tire from the wheel. However, this way is not always satisfactory because the larger the hole the greater the possibility of the plug loosening and leaking as a result of the constant flexing of the tire. The most satisfactory is a vulcanized repair. Not just a self vulcanizing patch on the inside of the tire but a repair that is vulcanized all the way through the tire. While it takes a little longer to make such a repair and costs the customer a little more it isn't difficult to sell the customer on the added protection.

The things to look for in a vulcanizer are, first, a heavy duty heat element capable of producing a complete cure all the way through the tread of a tire. Second, sufficient pressure and an easy method of adjusting to compensate for different thicknesses, i.e. sidewall and tread. Convenience is also important as, for example, the vulcanizers that hold the tire upright so that the operator looks down at the area being worked on instead of working in the dark from underneath.

Not only does good equipment make tire servicing more profitable but it helps to establish a reputation for quality that draws more service work to the shop.

Say You Saw It In
Automotive Service Digest

....do any service job faster with I-R air and electric tools

½" DRIVE
AIR
SIZE 403B

Handle all but the very largest nuts on cars and trucks with the lightweight 403B Impactool. The 403B—which weighs only 5 lbs.—is the most powerful tool of its size—a Select-Air regulator permits control for safe use on small jobs—an air compressor as small as 1½ hp will operate this tool. Compact design lets 403B fit into close quarter jobs, reduces operator fatigue. See your I-R Jobber for a convincing demonstration.

18-741-1

Ingersoll-Rand
11 Broadway, New York 4, N.Y.

Time to De-Winterize . . .

(Continued from page 13)

Make the test quickly, before boiling can start, because steam bubbles would give misleading results.

Even small leaks should be eliminated, because they will eventually permit liquid to get into the engine, if it has not already been admitted.

2. Using an adapter which can be made out of an old spark plug shell, apply about 100 psi of air pressure through each spark plug hole in turn, having the piston on dead center with valves closed. Air leakage from the cylinder will be indicated by air bubbles or rise of liquid in the radiator, or in the engine water outlet if the upper hose is disconnected. This is also a useful test for valve leakage—noise due to leakage through the exhaust valve can be heard at the exhaust pipe, or through the inlet valve at the carburetor with the air cleaner removed.

THE WATER PUMP

Inspection should be made for water pump leakage, a fairly common occurence. A pump seal which is dripping with the engine stopped or idling, may not give any indication at all when the engine is running at moderately high speed, since the suction of the running pump will draw in air and thus prevent liquid from running out. The same condition exists at all points of possible leakage on the suction side of the pump, including: heater hose connections to the engine or car heater, lower hose connections, lower tank of the radiator, and even leaks in the lower portion of the radiator core.

To check for air suction into the cooling system, a special test may be necessary, because water pump leakage cannot always be detected by inspection. A quick check for leaks on the suction side of the water pump can be made by using a piece of rubber tubing and a glass bottle filled with water. To make this test, first adjust the liquid level in the radiator, allowing for expansion when hot, so as to avoid any overflow loss during the test. Be sure the radiator cap is on tight. If it is a pressure cap, block open the pressure valve, or replace with a plain cap during the testing period.

Attach a suitable length of rubber hose to the lower end of the overflow pipe. All connections must be air tight. Run the engine in neutral at a safe high speed until it reaches a uniform operating temperature. Without changing speed, put the free end of the rubber tube into the bottle of water, and watch for bubbles.

BUBBLES CONTINUOUSLY

In the absence of exhaust gas leakage into the cooling system, a continuous flow of bubbles indicates that air is being sucked in. Any leak on the low pressure side of the pump that permits air to be drawn in at high speed, allows or will eventually allow, liquid leakage with the engine idling or stopped.

Air or gas drawn or forced in from leaks will be circulated with the coolant and will increase the apparent volume of the liquid, causing the level to rise in the radiator. Entrained air or gases in sufficient quantity cause large overflow losses of liquid while the vehicle is being driven.

The water pump is subject to failure from time to time, although generally speaking it gives very little trouble. Since there is always the possibility that the pump may be causing cooling system difficulties, it must not be overlooked in diagnosing this vital system.

The pump seal is a critical part of the pump. Its function is to make a liquid-tight seal around the shaft where it enters the liquid compartment, to prevent leakage. Most of the pumps in current use are equipped with a packless seal, which consists of a car-

made for each other . .

EIS

Super "50" BRAKE FLUID and Super-Quality BRAKE PARTS!

There's no room for penny-pinching when it comes to brake work! You can ruin the job and lose a customer forever by combining quality brake parts with an unknown, off-brand, sub-standard brake fluid!

EIS Super "50" Heavy-Duty Brake Fluid costs a few pennies more, but, it's well worth it! Use EIS Brake Fluid with EIS Brake Parts to insure a lasting job and a satisfied customer. Don't use a brake fluid that just barely covers the requirements in States that have brake fluid laws! **EIS Super "50" EXCEEDS SAE Heavy-Duty Specification 70R1!**

Yes — it's a perfect "marriage" when you combine EIS Brake Parts with EIS Brake Fluid; THEY'RE MADE FOR EACH OTHER!

CAR MANUFACTURERS USE SAE HEAVY-DUTY BRAKE FLUID BECAUSE NOTHING ELSE WILL DO! DON'T TAKE A CHANCE!

Write for Catalog THE Comprehensive BRAKE PARTS LINE

EIS AUTOMOTIVE CORP., MIDDLETOWN, CONN.

bon ring that seats against a bronze ring as the shaft rotates and carries with it the revolving portion of the seal and the impeller. If the seal breaks, the pump will have to be replaced or rebuilt. Seals of this type allow leakage if they become worn, warped, scored, corroded or broken.

Another trouble that occurs occasionally is a broken or rusted-out pin or key that drives the impeller on the shaft. When this happens, the shaft turns normally, but the impeller does not turn at all or turns so slowly that coolant circulation is seriously affected.

When overheating occurs and no other cause can be found, the water pump should be carefully checked, which may require removal and disassembly.

THE ROLE OF THE THERMOSTAT

The thermostat is another item that should be checked in preparation for hot weather driving. When the permanent type of anti-freeze is used in winter, a good many motorists like to have a 180° thermostat installed to give better car heating in cold weather. This is satisfactory for driving at moderate speeds; but may let the engine get hotter than it should on fast, long drives.

The thermostat governs the minimum operating temperature. If a 160° thermostat is used, it will allow as much coolant circulation as is necessary to maintain 160°; while a 180° thermostat maintains a minimum temperature of 180°. When an engine is working hard, at high speed and in continuous service for hours and in very hot weather, the coolant may get up to a higher temperature than it should. In other words, a 160° thermostat gives a greater amount of cooling reserve than a 180° unit.

It is a good idea to ask the car owner if he has the high temperature thermostat. If he has, and plans to do long distance driving, recommend the cooler thermostat.

Another important pre-summer check point in the cooling system is the pressure radiator cap. Practically all late model cars have pressurized cooling systems, with maximum pressures of from 7 psi to 15. Pressurizing is accomplished by means of the radiator cap, which is spring-loaded to release at the rated pressure.

The object of pressuring the cooling system is to raise the boiling point of the coolant liquid. It is well known that the boiling point of a liquid depends on the pressure at which it is confined. For example, at 7 psi above atmospheric pressure, the boiling point will be 232°F., compared to 212° at atmospheric pressure; while at 15 psi, the boiling point will be about 250°F.

The proper way to check pressure caps is to inspect them visually for nicks or breaks in the lower impact gasket, or in the lower sealing seat in the filler neck; then test the cap for the proper release point pressure. Several types of testers are available which will apply pressure to the radiator and cooling system in checking them for leaks, and will also check the pressure cap release point.

RUN HAND OVER CORE

It is important that the correct cap always be used on a pressurized cooling system, and that a car designed for pressurized cooling always have a pressure cap installed. Do not substitute an atmospheric cap for a pressure cap, nor use a pressure cap on a cooling system not designed for pressure.

A quick test of the condition of a cooling system, is to feel all over the surface of the radiator after the engine has been run up to operating temperature and then stopped. Notice whether there are any cold spots along either side, or near the center of the radiator core. Such cool areas would indicate a partially clogged core.

(Continued on following page)

NEW LIFE FOR OLD ENGINES!

RESTORE NEW-CAR POWER... SPEED... ECONOMY... with HOUSER VALVE SPRING SHIMS

INSTALL IN 2 QUICK, EASY STEPS

1 Determine thickness of shim needed with patented Houser Shim Gauge

2 Install proper thickness of Houser Shims (.035" or .020" thick) under valve spring

For only a few pennies, HOUSER SHIMS renew lost valve spring tension . . . overcome effects of valve grinding and wear. By restoring full factory-specified tension, they eliminate valve flutter and surge, rough idling, and loss of power. If your Jobber performs your complete cylinder-head service, ask him to gauge and shim the valve springs for complete customer satisfaction.

Houser Shims Mean Extra Power for your Customers' Engines . . . Extra Service Business for You!

WRITE TODAY for big illustrated Wall Chart and Catalog — FREE!

VALVE SPRING SHIM HOUSER

HOUSER ENGINEERING & MFG., INC.
Bluffton, Indiana

Time to De-Winterize . . .

(Continued from page 49)

One good test for proper coolant circulation is made with the vacuum gauge. Open the lower drain cock at the bottom of the radiator and connect it to the hose of the vacuum gauge. Start the engine and have it speeded up to about 2500 rpm. If circulation is normal, the vacuum gauge should indicate 3 to 4 in. of mercury. If the reading is more than 4 in., the liquid path is partially obstructed.

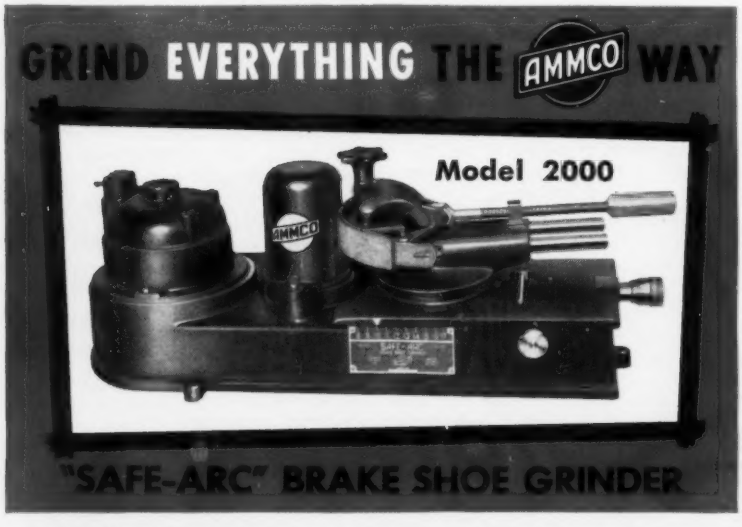
When the water pump in the cooling system is working, it "pulls" liquid from the bottom tank of the radiator, resulting in a decrease in pressure—in other words, a slight vacuum. If the radiator is slightly clogged, it is more difficult to draw liquid from the lower tank; and the pressure will be lowered still further, showing a higher vacuum on the gauge.

When cars begin to come in for spring change-over service, or the time arrives when they should come in, forward-looking shop men will find that it pays to prepare a spring service package including attention to the cooling system. Listing the various points of inspection and possible service, as discussed here, calls the car owner's attention to tests that are frequently neglected until trouble occurs. Preventive inspection and service pay real dividends to car owners, by keeping their vehicles running properly and minimizing the chances of breakdown or failure.

WHEN CHANGING YOUR ADDRESS

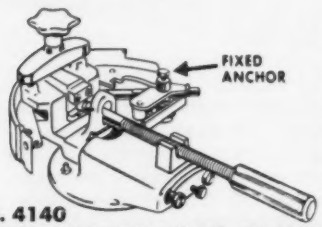
Please notify us 5 weeks in advance. Supply us with both your old and new address, including address label from current issue if possible. Copies we mail to your old address will not be delivered by the Post Office unless you pay them extra postage. **Mail address changes to Circulation Dept., Automotive Service Digest, 900 South Wabash Ave., Chicago 5, Ill.**

GRIND EVERYTHING THE AMMCO WAY



"SAFE-ARC" BRAKE SHOE GRINDER

Handle ALL brakes on ALL cars. Grind lining with or without grooves, for adjustable or non-adjustable anchors or for the "Center Plane" brake. Cam grind or grind to exact arc of drum or any oversize as required. Range includes shoes for drums 8″ to 17″. FAST – CLEAN – EASY TO USE.



No. 4140
FIXED ANCHOR SHOE CLAMP

Cures diving and pulling. Necessary for Model 2000 to grind shoes for 1955-58 Chevrolet, Nash, Packard, Hudson, 1956-58 Ford, Lincoln, Mercury, and 1958 Edsel. Can be used on any Safe-Arc Grinder, Serial No. 2560 and later.

NEW! **No. 4550**
LINING GROOVER

Where manufacturers recommend grooving the lining down the center – this accessory will do the trick! Fits ALL Ammco Model 2000 "Safe Arcs."

PRODUCTION EQUIPMENT

For those engaged in production brake shoe grinding, Ammco "Safe Arcs" are available with ½ or 1 h.p. motors. Also available, is the No. 4290 "Quick-Air" Shoe Clamp to provide air-powered shoe clamping. Fits all Ammco "Safe Arcs."

AMMCO TOOLS, INC.

Tell 'Em to Sell 'Em!

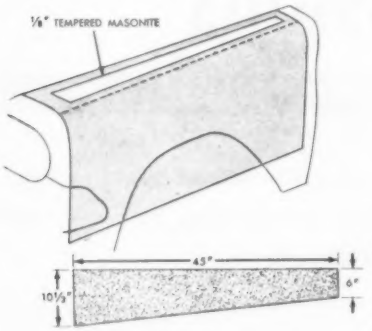
"Out of sight—out of mind" applies to many service needs. So it's a good idea whenever possible to remind your customer that it is good business to replace the oil filter, repack front wheels, and change the transmission oil.

One way to do this is to have a sign such as we see here conspicuously displayed in the lubrication department. This sign not only tells the price but suggests the mileage interval at which the suggested service should be performed. For example, this shop suggests replacing the oil filter every 5,000 miles; and repacking front wheel bearings is recommended at 5,000-mile intervals. But this is probably due to the fact that the average customer will stretch the recommendation one-hundred percent anyhow; and so it goes. At least the suggestion is there and it brings in business.

Impressive sign that boosts business in lube department.

Reinforced Fender Covers Give Added Protection

When performing under-the-hood operations, it is possible to damage the front fenders with tools or heavy engine parts unless adequate precau-



Fender cover reinforcement

tions are taken. To avoid accidental damage, a helpful suggestion is offered by Edsel's Service Department, who recommends that fender covers be reinforced as follows:

Cut a reinforcement from ⅛" tempered masonite or equivalent to the dimensions shown in the accompanying illustration.

Sew a canvas sleeve or pocket to the underside of the fender cover near the inner edge of the cover. Make sure the sleeve is at least one inch larger than the reinforcement, on all sides, when sewn in place. This will permit the reinforcement to slide easily into the sleeve.

The Stickin'est Valve . . .

(Continued from page 15)

inspection should be both visual and manual. The manual check is nothing more than turning the counterweight by hand to determine if it is securely mounted to the shaft, and also to see if the shaft is free to turn in the manifold.

The visual check is conducted by accelerating the engine several times to see if the counterweight "flutters." If it does, the unit is probably O.K. If it doesn't, the valve plate may be burned enough so that it is offering no resistance to the exhaust gases. In this case the entire assembly must be replaced.

If the valve is stuck in one position, it can be quickly loosened up by applying either the *Mopar Manifold Heat Control Valve Solvent*, or the *RSA Autocare and Penetrating Oil*. In a matter of minutes they will free a heat riser that has been stuck in one position for days, weeks, or months. For best results, the liquid should be applied when the manifold is cold. This is to make sure the light ends of the liquid do not evaporate until they have a chance to carry the special colloidal lubricant and lead oxide dissolving agents into all areas around the shaft. However, the solvent can be applied to a hot manifold without any serious effects. It just takes a little longer to work.

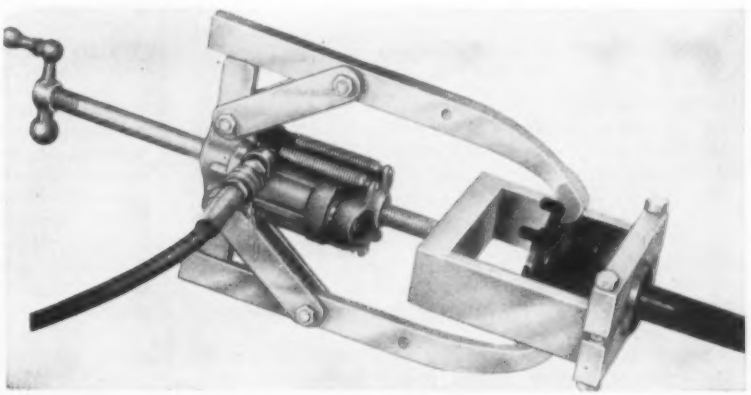
MUST BE USED REGULARLY

Because the heat riser must operate under such adverse conditions of extreme heat and deposit-forming exhaust gases, these solvents must be applied at regular intervals. Chrysler Corp. recommends a "treatment" every 1,000 miles or each 30 days.

Another point to keep in mind is that the thermostatic spring has an estimated average life of only 20,000 to 30,000 miles. After this much service it is advisable to replace the spring, even though it appears satisfactory.

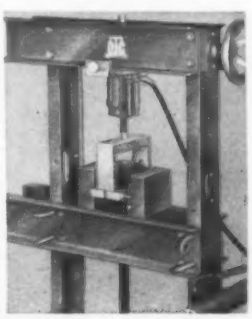
By checking the heat risers of every car which comes into your shop, and by educating the car owners on the necessity of maintaining their heat risers in good operating condition, you will be doing them a service, and you'll be increasing the quality of work your shop turns out.

In the end, this will result in good customer relations which automatically means more profitable business.



OTC "bridge" removes, installs rear-axle bearings fast, easy

No hammering, heating, beating when removing or installing flange-type rear-axle bearings — not with the new OTC "bridge" and Power-Twin hydraulic ram. Designed to work with OTC Grip-O-Matics (above), this "bridge" eliminates shaft bending or scoring, race injury or separation. Even zero-tolerance bearings are quickly eased off without binding or distortion. Use same "bridge" and Grip-O-Matic to quickly install new bearings. "Bridge" attachments fit virtually every car, including '58s.



Use this "bridge" with OTC (or other) shop presses (right). OTC Power-Twin hydraulic rams are similarly versatile, work with OTC accessories to do hundreds of jobs — remove and install gears, bearings, sheaves, pulleys — bend and straighten shafts.

RESEARCH · ENGINEERING · DEVELOPMENT · OTC

See your OTC jobber or write

Owatonna Tool Company

301 Cedar Street

Owatonna, Minnesota

Automatic transmissions

A complete series of articles covering automatic transmissions — their design . . . how they operate, and how they are serviced. Be sure to read and keep all future articles for ready reference.

Part VI—Servicing the Fordomatic

BY HERB CARRIER
Detroit Editor

• IT COULD HAVE HAPPENED this way, in the early 1900's:

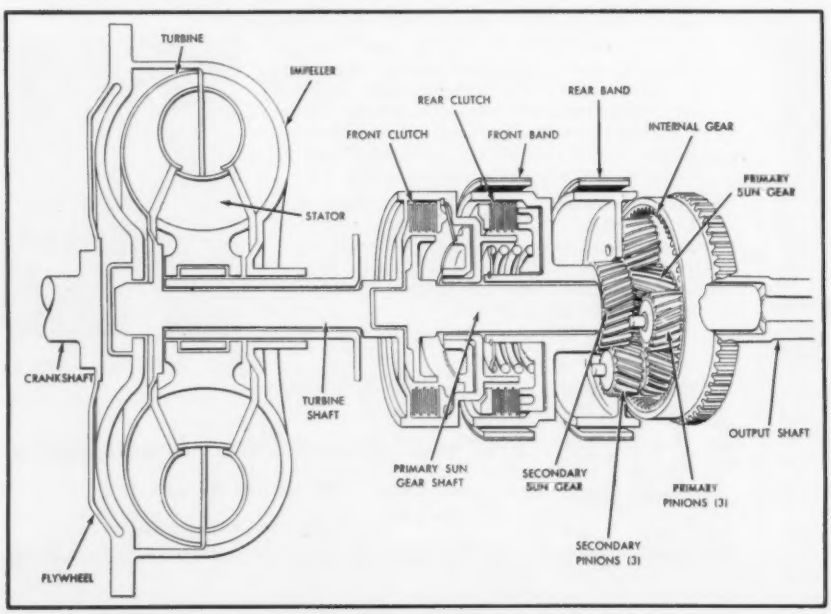
Scene: Interior of blacksmith shop. Heavily muscled man—clad in leather apron, heavy boots, and thick, woolen undershirt—is using one hand to operate the bellows of a small forge. With his other hand, he manipulates a pair of long handled tongs which he dips occasionally into the shimmering coals to make sure a piece of metal heats evenly to a bright, cherry red.

Suddenly, the metal is just the right color. Quickly he steps to his anvil, grasps a hammer, and beats out a beautifully rhythmical tune. Whack, whack, goes the hammer on the heated metal followed by a series of sharp, high-pitched rings as he bounces the hammer on the anvil while critically flipping the tongs to view the forming metal.

Enter: Male customer in celluloid collar, striped shirt with sleeve garters, and neatly rolled Derby hat. He interrupts the "smitty" to ask: "Say, Joe, how about adjusting the bands on my transmission."

Something wrong with this picture? Not really. It could have happened. Henry's old Model "T" used a planetary gear transmission that incorporated bands to hold the various units to select the different drive ratios.

It wasn't an automatic transmission, of course. Foot pedals instead of hydraulic servos were used to operate the bands, but the principle was the same as modern automatics. And a band adjustment on a Model "T" Ford was made for the same reasons a band adjustment is



The Fordomatic consists of a torque converter, a clutch assembly and a planetary gear train—plus, of course, the necessary hydraulic and mechanical controls. The 6-cylinder Fordomatic uses an aluminum converter; 8-cylinder and Cruise-O-Matic use a permanently welded steel converter which cannot be disassembled.

made on a 1958 Fordomatic, or most every automatic transmission in use today.

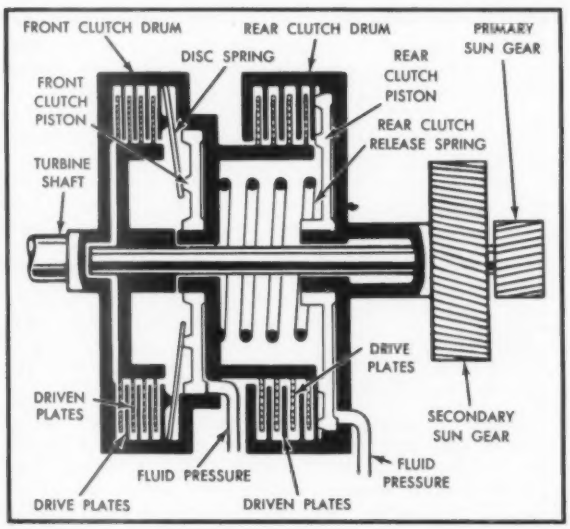
FORDOMATIC CONSTRUCTION

Automatic transmissions used in modern Ford cars consist of a torque converter, two clutch units, a compound planetary gear train, a housing, and the manual and hydraulic controls.

Torque Converter: Consists of three basic units—a turbine, a stator, and an impeller. All these parts are enclosed and operate in a fluid-filled housing.

The engine-driven impeller has a series of curved blades equally spaced around the inside surface. The turbine is similar to the impeller except that its blades are curved in the opposite direction, and it is connected to a turbine shaft.

The stator, located between the impeller and turbine, is attached to a support on the transmission case through



Clutch assembly contains both front and rear units, which are similar except that the front unit uses a disc-type spring, and the rear unit a coil spring. Both units have series of bronze-faced plates and steel plates which provide means of transmitting power. When plates are pressed together—through hydraulic action—the clutch is "applied." When plates are separated—by spring action—clutch is "released."

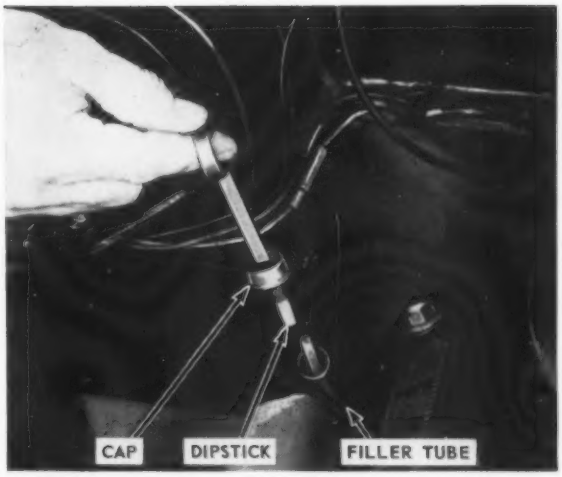
a one-way clutch, which permits the stator to spin only in the direction of impeller rotation.

Front Clutch: Consists of drum, piston, disc spring, steel drive plates, and bronze-faced driven plates.

The drive (steel) plates are connected to the turbine shaft through the front clutch drum. The driven (bronze-faced) plates are connected to the primary sun gear shaft.

Rear Clutch: Also consists of drum, piston, bronze-faced drive plates, and steel driven plates. But the rear clutch uses a coil-type release spring rather than a disc spring as in the front clutch. Rear clutch drive plates are splined to the front clutch drum. Driven plates are connected to the rear clutch drum and secondary sun gear.

Planetary Gears: Consist of primary sun gear, secondary sun gear, primary and secondary pinions (held in common carrier), and an internal gear to which the transmission output shaft is attached



Dipstick is readily available in the engine compartment. *Always* check oil level while engine is running, and be sure to wipe cap and top of filler tube clean *before* removing stick.

This year the Ford Motor Co. is offering an additional automatic transmission called Cruise-O-Matic. Both Fordomatic and Cruise-O-Matic have the same basic components and the same power flow except for the additional D1 range of Cruise-O-Matic:

Neutral: No clutch, no bands.

Second Gear: Drive primary sun gear—hold secondary sun gear. (Front Clutch—Front Band.)

Third Gear: Lock together primary and secondary sun gears. (Front Clutch—Rear Clutch.)

First Gear (Fordomatic): Drive primary sun gear—hold pinion carrier. (Front Clutch—Rear Band.)

First Gear (Cruise-O-Matic): Hold pinion carrier. Drive primary sun gear. (One-way Clutch—Front Clutch.)

Reverse: Drive secondary sun gear—hold pinion carrier. (Rear Clutch—Rear Band.)

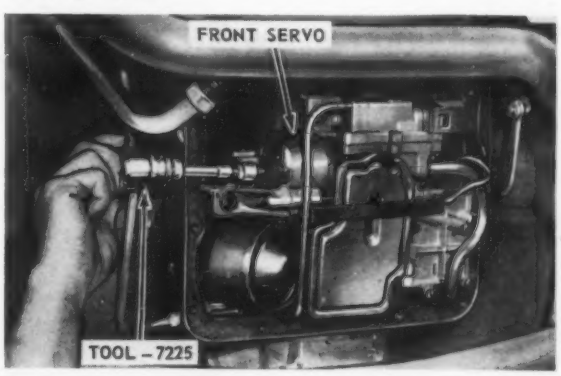
Park: Engage parking pawl with external teeth on internal gear.

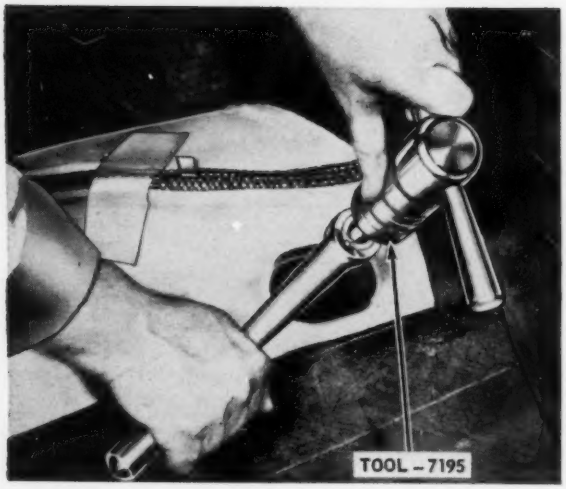
PERIODIC SERVICE IS REQUIRED

Through the years, Ford automatics have proved themselves to be dependable units which usually require

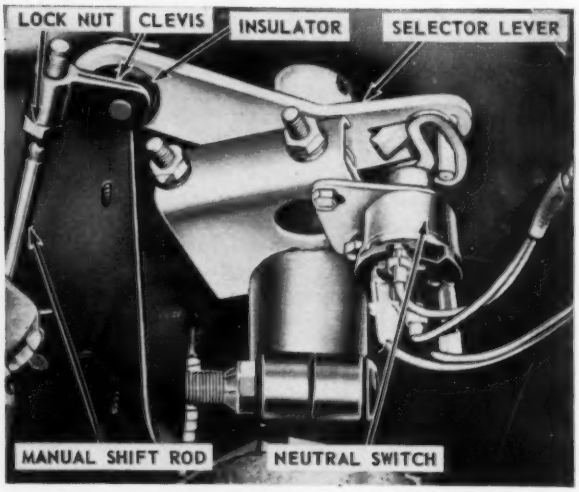
(Continued on following page)

Front band adjustment requires draining transmission fluid, and removing oil pan.





Access hole for rear band adjustment is underneath the front floor mat. Before making adjustment, clean away dirt around adjusting screw.



The manual linkage adjustment and the starter switch adjustment are made at the assembly which clamps to the steering column mast-jacket.

Transmissions . . . CONTINUED

only periodic service. But, strangely enough, this service is not always performed periodically. Mostly because customers get used to their cars somewhat like they get used to their shoes. They don't seem to notice the gradual day-by-day, mile-by-mile wear that takes place. Not until they get new shoes do they realize how loose the old ones were. Likewise, not until a competent mechanic performs much needed adjustments to their automatic transmission do they realize how badly they were needed.

Consequently, it's usually the mechanic's responsibility to inspect automatic transmission operation when customer's cars are in the shop for lubrication, tune-ups, or other maintenance.

ADJUSTMENTS INFLUENCE OPERATION

As you know, even slight misadjustments can drastically affect the operation of an automatic transmission.

By making quick, inexpensive adjustments—with the customer's O.K.—you can dramatically improve transmission operation, so much so that even the customer will be amazed and delighted.

In this way, you gain character, and become a hero. Plus the fact that you pick up a few extra bucks.

PRELIMINARY CHECKS

Fluid Level: Place car on level floor, set hand brake, and run engine until it reaches normal operating temperature. Shift selector lever through all quadrant positions, and place lever in "P" (Park), with engine idling.

Carefully wipe all dirt away from dipstick cap. Remove stick, wipe clean, and insert again to take reading.

If fluid checks low, add enough Type A Automatic Transmission Fluid to bring level to the F (full) mark on the dipstick. Stop engine.

Stall Test (Fordomatic): This test, properly conducted, will determine if the bands and clutches are holding correctly. Connect a tachometer, run engine and allow it to reach normal operating temperature. Apply both the hand brakes and service brakes.

Place selector lever in "Dr" (Drive), and press accelerator pedal down until it reaches detent. *DO NOT GO THROUGH DETENT* as this will cause a shift from intermediate to low.

Also, *DO NOT* hold throttle open for more than five (5) seconds at a time.

Maximum engine r.p.m., with transmission in gear and brakes firmly set, will indicate holding efficiency of the clutches and bands. For exemple, if engine speed exceeds recommended limits when selector lever is in "Dr" (Drive), front clutch or front band slippage is indicated.

To help pinpoint which of the units is actually slipping, shift selector to "Lo" (Low) and repeat test. If high r.p.m. again results, the front clutch is slipping. If r.p.m. is within limits, in "Lo" (Low), but excessive in "Dr" (Drive), the front band is slipping.

Excessive r.p.m. in "R" (Reverse) indicates slippage of rear band or rear clutch. Here again, the faulty unit can be pinpointed by shifting into "Lo" (Low) and repeating test. If slippage (high r.p.m.) shows up in "Lo" and "R" but not in "Dr", the rear band is slipping. High r.p.m. in "R", but not "Lo" or "Dr" means the rear clutch is slipping.

After conducting several stall tests, the procedure and readings quickly register in your mind. In a matter of just a few minutes you can accurately detect a faulty component.

For ready reference, post the following chart on your tool box, or, better still, memorize it and file it away in your grey matter:

Slippage Indicator

"Dr" = Front Clutch or Band (second gear—not through detent)
- "Lo" = Front Clutch
- "Dr" (but not "Lo") = Front Band

"R" = Rear Clutch or Band
- "Lo" and "R" (but not "Dr") = Rear Band
- "R" (but not "Lo" or "Dr") = Rear Clutch

Stall Test (Cruise-O-Matic): The foregoing Fordomatic stall test information applies to Cruise-O-Matic, except that (1) pedal is pressed *THROUGH DETENT* in either D1 or D2 because transmission will not downshift when the car is standing still, (2) in D1 (car still) front clutch and one-way clutch are engaged at all accelerator positions, and (3) in D2 (car still), front clutch and front band are engaged in all accelerator positions.

BAND ADJUSTMENT

Quite often, adjustment will correct a slipping band. Adjusting procedure is comparatively simple, and requires only two (2) low-cost special tools. plus an oil pressure gauge and a tachometer.

Band adjusting procedure is identical for Fordomatic and Cruise-O-Matic transmissions. The rear band is adjusted through an access hole in the floor pan. The front band requires transmission oil pan removal.

If the transmission fluid is to be re-used after front band adjustment, care must be taken to use a clean drain pan. Also, the manufacturer recommends straining the fluid through a fine mesh screen to remove foreign particles which might damage the transmission.

Re-use only fluid in good condition. *Always* use a new oil pan gasket, and clean pan thoroughly.

Front Band Adjustment: Drain fluid, and remove oil pan. Loosen servo adjusting screw locknut two (2) full turns. Operate adjusting screw manually to check for freeness. Insert adjusting tool gauge block between screw and servo piston stem.

Tighten adjusting screw with adjusting tool wrench until wrench overruns the screw. This is the point where the wrench handle slips without turning the tool blade.

Then (and this is important), back off screw one (1) full turn. *Serious damage to the transmission may result if the adjusting screw is not backed off exactly one (1) full turn.*

Hold screw staticnary, and securely tighten locknut. Remove tool, replace pan, and refill transmission.

Rear Band Adjustment: Fold back front floor covering, and remove access hole cover near the right center of the floor pan. Clean area around adjusting screw. If screw threads look rusty, lubricate them with light engine oil.

Using adjusting tool, loosen locknut about one-half (½) turn. Tighten screw with T-handle of adjusting tool until the tool overruns. Again, this is the point where the handle will slip without further tightening the screw.

Back off screw exactly one and one-half (1½) turns, and securely tighten locknut.

CONTROL LINKAGE ADJUSTMENTS

Manual Lever: Disconnect shift rod clevis from shift selector lever. Position selector lever so that quadrant indicator is against the stop in the "Dr" (Fordomatic) or D1 (Cruise-O-Matic) position.

Place manual lever on transmission in the "Dr" or D1 detent (second from bottom).

Adjust clevis so that clevis pin freely enters lever insulator. Secure pin, and tighten clevis locknut. Check pointer alignment in all positions.

Throttle Linkage (6 cylinder): Disconnect throttle control rod clevis. Pull control rod *upward* to hold the throttle lever against the main control stop.

Adjust clevis so that clevis pin freely enters hole in lever. Then *lengthen* rod two and one-half (2½) turns to obtain approximate setting.

Connect rod to accelerator shaft, and turn threaded trunnion as necessary to provide three and one-eighth (3⅛) inch accelerator pedal height.

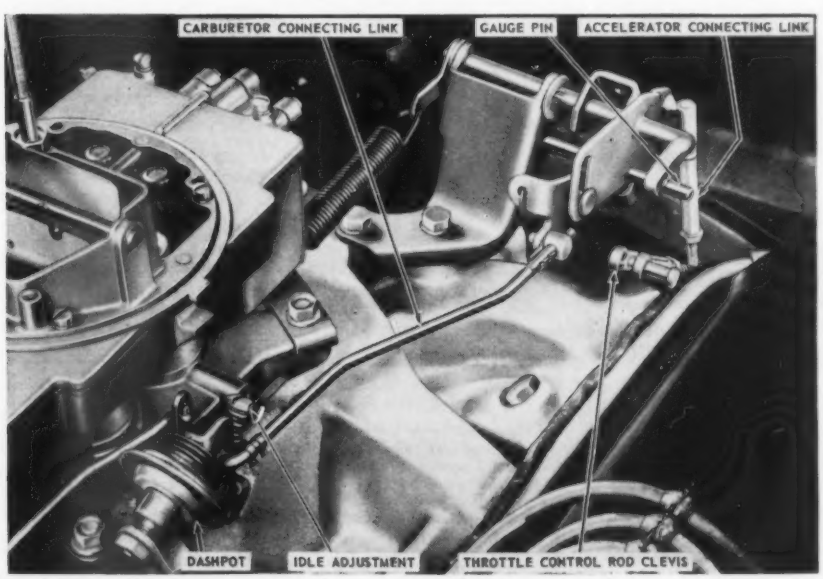
Throttle Lever (8 cylinder): Disconnect throttle control rod from accelerator. Insert gauge pin (¼" drill rod) through gauging holes. Adjust carburetor connecting link so that carburetor lever is against its hot idle stop. *Automatic choke carburetor linkage must be OFF fast idle cam.*

Adjust accelerator connecting link to establish three and one-eighth (3⅛) inch pedal height. Remove gauge pin (it should slide out freely).

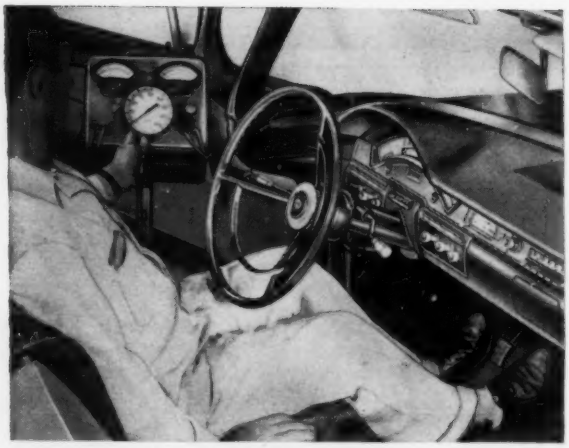
Pull throttle control rod *upward* to hold transmission lever against its internal stop. Adjust clevis until clevis pin freely enters hole in lever. Lengthen rod by rotating clevis three (3) turns counterclockwise. Then connect throttle control rod to accelerator lever. This is the approximate setting.

(Continued on following page)

FORDOMATIC & CRUISE-O-MATIC STALL SPEEDS		
ENGINE	ENGINE STALL SPEEDS (RPM)	
	FORDOMATIC	CRUISE-O-MATIC
FORD I-6	1370-1570	
FORD Y-V-8	1530-1730	
INTERCEPTOR V-8	1430-1700	1430-1700



Fordomatic throttle linkage on the 8-cylinder models is similar to this Thunderbird hook-up.



Final linkage adjustment specifications must fall within recommended limits. In making this pressure check, *do not* operate car under stall or near stall conditions any longer than necessary to obtain accurate readings.

Transmissions . . . CONTINUED

For final adjustment, remove the pipe plug from transmission case (the plug is located either forward of the transmission levers, or on the rear face of the transmission case). Install pressure gauge hose fitting in the threaded hole. Also, connect tachometer to engine.

Start engine, and set service and hand brakes. Place selector lever in "Dr" (Fordomatic), or D1 or D2 (Cruise-O-Matic). Increase engine speed to 1,000 r.p.m., and note pressure gauge reading. It should be 80 to 85 psi.

If pressure is *low,* rotate clevis to *lengthen* throttle rod. If pressure is *high,* rotate clevis to *shorten* throttle rod.

When reading is within limits, stop engine, remove gauge and tachometer, and install pipe plug. Double check to be sure all pins and locknuts are secure.

Starter Switch Adjustment: Position neutral switch on steering column so that starting motor will operate only in "N" (Neutral) or "P" (Park).

Dashpot Adjustment (internal type): Hold carburetor linkage in "wide open" position. Measure distance from top surface of air horn to top of plunger shaft. This should be 7/16 inch. If necessary, bend lug on dashpot operating lever to establish correct distance.

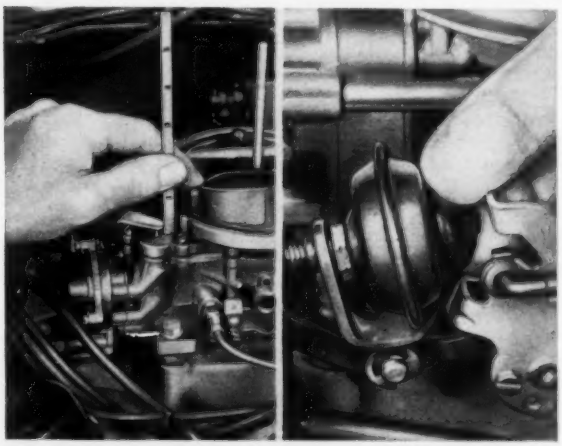
Dashpot Adjustment (external type): Loosen dashpot locknut and bottom plunger. With carburetor linkage in hot-idle position, measure clearance between bottomed plunger and throttle shaft lever. This should be .045"-.065" on all carburetors except Ford carburetors on 8-cylinder engines. These carburetors require .060"-.090" clearance.

If necessary, turn dashpot or dashpot adjusting nut to obtain recommended dimension. Secure locknut.

Check idle speed, and adjust to specifications. If dashpot holds throttle open and prevents correct idle speed adjustment, readjust dashpot clearance so that correct idle speed can be obtained.

GOOD ROAD TEST IS A MUST

A "must" step for all automatic transmission work includes a good road test. Put the unit through its paces. Check for smooth upshifts and downshifts. Be sure the full throttle downshift works properly. Check shift points to see that they occur at proper road speeds.



Two types of anti-stall dashpots are used on late model Ford transmissions—The external type, shown on left, and the internal type, shown on the right. Methods of making adjustments are given in text.

Watch for excessive creeping, or any tendency to stall. In short, be as critical as you can. Make sure it's a good job before turning the car over to its owner.

Remember, a well-done service job can be your best advertising.

Next Month: Servicing PowerFlite.

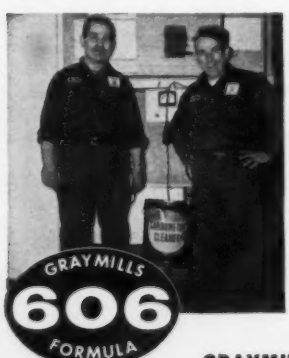
Take A Tip . . .

"Many a car owner who thinks he is having trouble with his battery or generator should take a good look at his fan belt," says Frank P. Plovick, field service manager for the Delco-Remy Div., General Motors Corp.

If the belt has become worn or loose as a result of severe winter driving conditions slippage may occur on the generator pulley resulting in failure to charge. "Many electrical systems have been condemned," Plovick adds, "when a loose belt was the real offender.

WHEN CHANGING YOUR ADDRESS

Please notify us 5 weeks in advance. Supply us with both your old and new address, including address label from current issue if possible. Copies we mail to your old address will not be delivered by the Post Office unless you pay them extra postage. **Mail address changes to Circulation Dept. Automotive Service Digest, 900 South Wabash Ave., Chicago 5, Ill.**



leaves no odor—cleans faster.

"I LIKE 606 BECAUSE . . .

it has all the high qualities a carburetor cleaner should have, economical, fast, easy on the hands, very little odor and a perfect water rinse."

Signed testimonial from service men at Bayer City Service, 49th and College, Indianapolis, Ind.

GRAYMILLS CORPORATION 66

3736 N. Lincoln Ave., Chicago 13, Ill.

CURRENT, REALISTIC, AUTHENTIC VALUATIONS

Backed by 47 Years of Dependability

That's why you can rely on

RED BOOK

USED CAR APPRAISALS

- Reliable finance or cash values
- Average "as is" or wholesale values
- Realistic impartial retail values
- Over 20 foreign cars listed in separate section
- Front view illustrations for fast identification
- Title, license plate, sales and use tax data
- Appraisals include automatic transmissions except in low priced group

Covers values for your trading area — current, compact, unbiased, easy to use. Included are appraisals on all passenger cars for the past nine years; trucks through 1½ ton capacity for eight years; plus important specifications, data, and insurance symbols.

NEW REVISED EDITION EVERY SIX WEEKS

FULL YEAR'S SERVICE, $8.00

With this complete, dependable, authoritative service, you can appraise used cars at *the right prices—for profitable trades, sales or purchases.*

Only Red Book Provides This Full, Reliable Service

. . . and for reliable TRUCK APPRAISALS THE BLUE BOOK

The Blue Book is the only service that provides truck valuation and data for practically all makes regardless of tonnage. Appraisals covering the past eight years are realistic, authentic.

Data include model, motor and serial numbers, capacity, G.V.W., W.B., H.P. rating and factory prices. Published semi-annually.

YEAR'S SERVICE, JUST $10

NATIONAL MARKET REPORTS, INC. 900 S. Wabash Ave., Chicago 5, Ill.
Automotive Publication Services Since 1911

MAIL THIS 30-DAY FREE TRIAL COUPON **MONEY-BACK GUARANTEE**

NATIONAL MARKET REPORTS, INC., 900 S. Wabash Ave., Chicago 5, Ill.
Please enter our order for the one-year services checked below*, subject to your 30-day money-back guarantee.

- ☐ Red Book Official Used Car Appraisals (Except Reg. "C").. $ 8.00
- ☐ Red Book Pacific Coast Edition, Region "C"..... $ 9.50
- ☐ National Parts & Labor Manual — Master Edition with Illustrations and Revisions for a Full Year..... $16.50
- ☐ Check enclosed for $..... ☐ Send C.O.D. (Plus Charges)
- ☐ Blue Book Official Truck Appraisals..... $10.00
- ☐ National Farm Tractor and Implement Blue Book..... $ 5.00
- ☐ Automotive Service Digest — Monthly — For a Full Year.. $ 4.00
- ☐ (In combination with any other service)..... $ 3.50

Firm Name.....

Street Address.....

(Quantity Rates on Request) *Rates for United States and Canada only

City..... Zone..... State.....

Indicate ☐ New Car or ☐ Truck Dealer..... (Make)

OR OTHER LINE OF BUSINESS.....

Universal joint service

With the adoption of the three-joint propeller shaft assembly and present trend towards more universals, the independent repair shop should get its house in order to adequately handle this important and profitable service.

By BEN IKERT
Editor

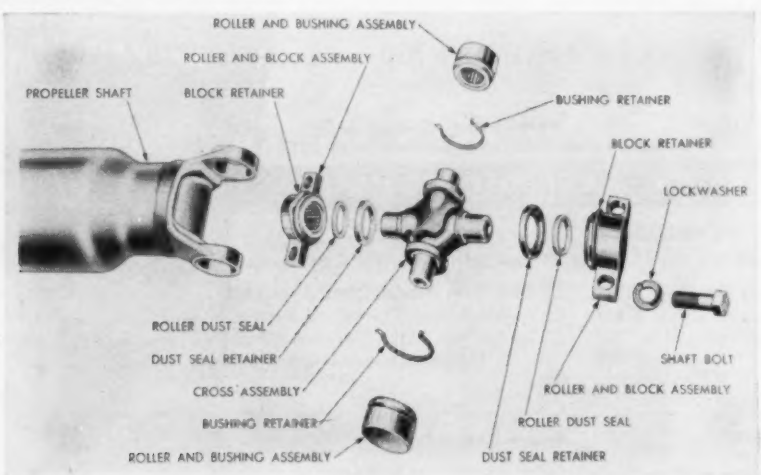
● IN THE SERVICING of universal joints the shopman may be confronted with the job of replacing an old or worn joint with which he is unfamiliar as to make and model. Various makes of universal joints—Spicer, Blood, Detroit, Cleveland and Mechanics, naturally are made in a wide range of sizes or series.

Each of these sizes or series has distinguishing characteristics which permit identification from measurement, the information for which is had from joint manufacturers' specification sheets or catalogs. The several different designs all can be identified by noting the various methods used to retain the bearings in the yokes.

The universal joint makers' specifications show illustrations of component parts from which the name of the part required can be determined. Then, it becomes a matter of checking the dimensions of the existing part against the measurements of the same part in the specs.

For example, let's say that by referring to illustrations in the maker's catalog the part turns out to be a flange yoke as in Fig. 2. The next step is to measure the old yoke. This includes, the distance across the lugs (E); bearing diameter (D); flange diameter (A); bolt hole circle (B); diameter and number of bolts; pilot diameter (C) and flange to face line (G).

Fig. 1. Parts of a typical cross-and-yoke type universal in which the roller and bushing assembly are retained by snap rings. Many of these universals are bolted to the driving or driven flange with bolts passing through the four bolt holes of the two block retainers on one arm of the cross.



These measurements are then checked with corresponding measurements in the maker's catalog showing dimensions of flange yokes. Identification then becomes a simple process of elimination by comparing the measurements of the sample with the dimensions of similar parts shown in the catalogs. This same procedure can be followed on all parts to be replaced regardless of the make of joint

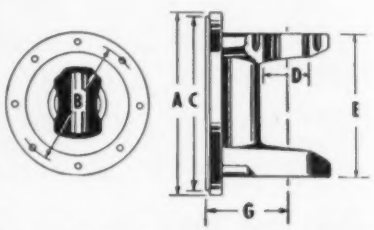


Fig. 2. Flange Yoke. Letters A, B, C, D, E and F indicate measurements to make for part identification.

SHAPES, MEASUREMENTS DIFFER

The shape of the different individual makes of joint parts will naturally differ somewhat and the measurements will be taken from different points. Therefore, the information of the manufacturers' catalogs should be followed. In the checking and identification of parts, the shopman will find that there are a number of parts like companion flanges, end yokes, end fittings, and sleeve yokes which call for measuring the spline hole, taper hole and the hub diameter. These measurements, again, should be made in the order shown in the makers' specifications.

When it comes to measuring Mechanics type yokes, the shopman must make sure to determine the swing

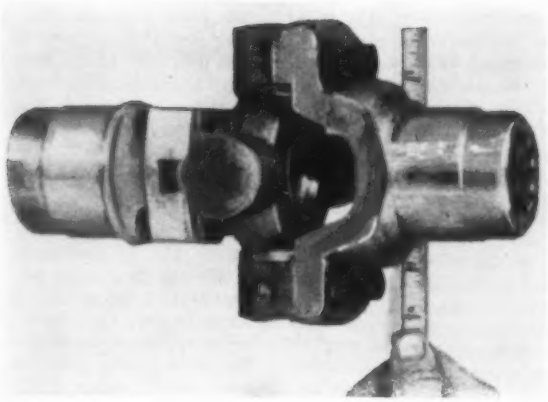


Fig. 3. Measuring yokes of a Mechanics universal for determining the correct size.

diameter (Fig. 3) in order to determine the size, and then proceed with the rest of the measurements.

MAKE AND MODEL MUST BE KNOWN

The general procedure when the make and model of joint is not known is to obtain from the customer the make, model, year, wheelbase, transmission or axle location of the assembly in the chassis. After locating the make and model of the car or truck it will be noted in the manufacturer's spec sheets that all components of a given assembly are shown. Some makers also show a suggested unwelded center assembly number that may be used. This unwelded center assembly is a complete shaft assembly, welded at the weld yoke only. In most instances nothing more need be done except to determine the end fittings, then cut to length and weld.

If there is doubt about the make, model and year, then the shopman should obtain the following measurements for the flange and yoke type joints:

Flange diameter and pilot diameter; bolt circle, diameter and number of bolt holes. The flange yokes can then be selected from the tables in the maker's catalog.

For end yoke types, obtain the hole size and kind (taper, spline, etc.) length of hole and diameter of hub. With these data, the end yoke can be selected.

MOST CALLED FOR SERVICES

Of all the services the shop which specializes more or less in universal joint work will be called upon to render, the most important will be identifying, measuring and duplicating the original (old) shaft sub-assembly. In addition, the shop may be called upon to shorten or lengthen the original shaft sub-assembly. In this, the joint makers recommend the following procedure:

A—From inspection determine the make and type of the original shaft sub-assembly from the illustrations in the several joint manufacturers' catalogs.

B—Determine the size: (1) Measure the distance across the lugs; (2) Measure the bearing diameter.

C—Identify the component parts of the original shaft sub-assembly: (1) Measure the stub ball yoke (weld yoke) or end fitting; (2) Measure the stub shaft or shaft fitting.

D—Select the new replacement parts required to make the duplicate shaft sub-assembly or to replace any of the worn components. Experience will dictate whether any of the parts on the original assembly may have any salvage value.

To lengthen a shaft sub-assembly always use a new stub ball yoke and tube assembly or a new piece of tubing.

E — Determine the length. Compare the original shaft sub-assembly to one of the illustrations in this article and do the work in accordance with the procedure given for the types illustrated.

To duplicate the assembly shown in Fig. 4, measure on the old or original shaft sub-assembly the length A. Measure from the bottom of the cross hole to the end of the spline. Measure length B on the new slip stub shaft, doing so from the end of the spline to the point of weld. From length A subtract length B to obtain the tube cutting length C of the new stub ball yoke and tube assembly. Length C is measured from the bottom of the cross hole to the point of weld parallel to the tube.

The next step is to insert the slip stub shaft into the tube, straighten and weld. This procedure was fully explained in our January, 1958 article on universal joint service.

To duplicate the assembly shown in Fig. 5, make measurement A on the old assembly. The distance A, or length, is measured from the bottom of one cross hole to the bottom of the other cross hole. Measure length B on the new stub ball yoke or weld yoke. Length B is from the bottom of the cross hole to the point of weld. From length A subtract length B, which gives the tube cutting length C of the new stub ball yoke and tube assembly. Length C is taken from the bottom of the cross hole to the point of weld parallel to the tube. (Length D is given in the maker's catalog to assist in identification and measuring.)

The final step is to insert the stub

(Continued on following page)

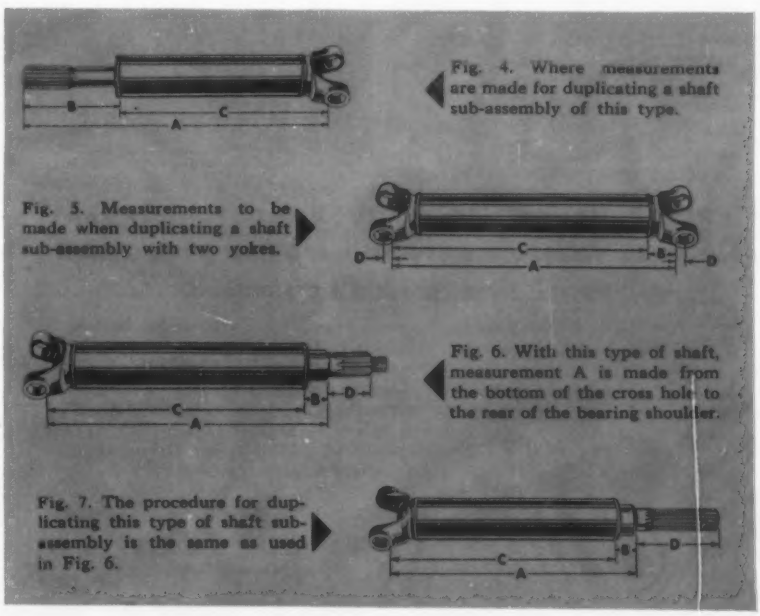


Fig. 4. Where measurements are made for duplicating a shaft sub-assembly of this type.

Fig. 5. Measurements to be made when duplicating a shaft sub-assembly with two yokes.

Fig. 6. With this type of shaft, measurement A is made from the bottom of the cross hole to the rear of the bearing shoulder.

Fig. 7. The procedure for duplicating this type of shaft sub-assembly is the same as used in Fig. 6.

ball yoke or weld yoke into the tube, straighten and weld.

The detailed measuring procedure with a shaft sub-assembly involving a bearing shoulder (see Fig. 6) is as follows: On the old shaft measure the length A, from the bottom of the cross hole to the rear of the bearing shoulder. Next, measure length B on the new midship stub shaft. It is measured from the rear of the bearing shoulder to the point of weld.

From length A subtract length B to obtain the tube cutting length C of the new assembly. Length C is measured from the bottom of the cross hole to the point of weld parallel with the tube. Length D is supplied in the maker's catalog to help in checking. The midship stub shaft is now inserted into the tube, straightened and welded.

When duplicating a shaft sub-assembly of the type illustrated in Fig. 7, the same procedure is followed as with the type shown in Fig. 6.

Referring to Fig. 8, measure the length A from the bottom of the cross hole to the large diameter of the taper. Length B, is then measured on the new midship stub shaft. It is measured from the large diameter of the taper to the point of weld. From length A subtract length B for getting the tube cutting length C of the new assembly. Length C is measured from the bottom of the cross hole to the point of weld parallel with the tube.

SHAFT WITH SPLINE AND TAPER

A shaft sub-assembly incorporating a spline on one end and taper on the other is shown in Fig. 9. Length A is measured on the old shaft assembly and includes the end of the spline to the large diameter of the taper. Length B is measured from the large diameter of the taper to the point of weld on the new midship stub shaft. Measuring from the end of the spline to the point of weld gives distance E on the new slip stub shaft.

Adding lengths B and E and subtracting this from length A is the cutting length of the new piece of tubing. As in previous instances, length D is given in the maker's specs to assist in checking. Both stub shafts are inserted into the tube, straightened and welded.

Another type of shaft sub-assembly that may be encountered for duplication is shown in Fig. 10. Here, distance A is the length measured from the bottom of the cross hole to the rear of the bearing shoulder. Length B is measured on the new midship sleeve, from the rear of the bearing shoulder to the point of weld. Length B is subtracted from A to obtain the tube cutting length C of the new stub ball yoke and tube assembly. C is measured from the bottom of the cross hole to the point of weld, parallel with the tube. Inserting the midship sleeve into the tube, straightening and welding follows.

DUPLICATING DETROIT BALL TYPE

Duplicating the Detroit ball type shaft sub-assembly (Fig. 11), consists of measuring length A on the old assembly, from the centerline of the one ballhead hole to the centerline of the other ballhead hole. Lengths B and D are measured on each of the ballheads. In each case the measurement is from the centerline of the ballhead to the point of weld. The sum of lengths B and D is subtracted from length A to obtain the cutting length C for the new piece of tubing. The tubing is cut to length C and ballheads are inserted, straightened and welded.

Another Detroit ball type assembly is shown in Fig. 12. Procedure is similar excepting that there is only one ballhead to insert in the tube and weld. Length A is measured from the centerline of the ball stub yoke to the centerline of the ballhead hole. Length B is measured on the new

Install the joint kit that protects both the vehicle and the customer!

NEW SPICER IMPROVED UNIVERSAL JOINT SEAL

keeps out dust . . . dirt . . . water—assures better performance, less "down" time, greater satisfaction!

This new Spicer lip-type seal protects Spicer Universal Joint bearings under all operating conditions!

It has been tested and proved in military, commercial and passenger car service for over 5 years. It is a sales-maker because it definitely assures less universal joint bearing wear, fewer repairs and replacements, longer and more economical performance.

The exclusive Spicer seal is available only in Spicer Universal Joints for original equipment, and in Spicer Universal Joint replacement kits for service.

Spicer

DANA CORPORATION
Toledo 1, Ohio

PRODUCTS OFFERED BY DANA: SPICER AND "MECHANICS" TYPE UNIVERSAL JOINT REPLACEMENT KITS • SPICER UNIVERSAL JOINTS AND DRIVE LINES • SPICER TRANSMISSIONS, CLUTCHES AND AXLES • AUBURN CLUTCHES MONMOUTH CLUTCH PLATES • SPICER POWER TAKE-OFFS AND PTO, INDUSTRIAL, AND AGRICULTURAL JOINTS.

Fig. 8. In this type of shaft, measurement A is made from the bottom of the cross hole to the large diameter of the taper.

Fig. 9. Measurements to be made on a shaft with a spline on one end and a taper on the other.

Fig. 10. Where this type of shaft is encountered the maker's specification of length D, is helpful in checking and identifying the original midship sleeve.

ballhead, from the centerline of the ballhead to the point of weld. Length B is subtracted from length A to obtain the tube cutting length C of the new yoke and tube assembly. Length C is from the centerline of the stub ball yoke to the centerline of the ballhead. To complete the duplication the shopman must insert the ballhead into the tube, straighten and weld.

The information and illustrations in this article apply mainly to Spicer and Detroit universal joints, but for all other similar types of shaft sub-assemblies the procedures are the same. However, the point of measurement will usually be taken from the centerline of the cross hole to the end of the spline or to the end of the thread on midship stub shafts.

On Mechanics shaft sub-assemblies with wing type bearings, these measurements are usually made from the face of the weld yoke to the end of the spline or to the end of the thread on midship stub shafts.

USE OF INCREASING BUSHINGS

There are instances in the build-up of universal joint drive lines when it is necessary to use various replacement parts having a smaller butt diameter than the tubing to be used. This difficulty may be overcome by using increasing bushings (Table 1) to adapt the smaller butt diameter to the larger diameter tube. The bushings are available from the maker of Detroit universal joints.

After the tubing has been cut to length and prepared for the fittings as was described in the January, 1958 issue of AUTOMOTIVE SERVICE DIGEST, a suitable bushing can be selected from Table 1. Chuck the bushing in a lathe and turn the inside diameter to .002″ to .005″ smaller than the butt of the slip stub shaft or midship stub shaft.

Remove the bushing from the lathe and press it on the butt of the stub shaft. This can be done in a small hand press, or a babbit hammer can be used by striking lightly around the flat side of the bushing. Put the shaft back in the lathe, chucking on the neck or spline of the stub shaft.

Next, turn the outside diameter of the bushing which was pressed on the stub shaft, to a tolerance of .002″ to .008″ larger than the inside diameter of the tubing for a press fit to the tubing. In turning the outside diameter at the point of weld, cut the shoulder to approximately a 30° angle for the weld bead.

Remove the shaft from the lathe and assemble it to the tube, following the procedure outlined in our January, 1958 article.

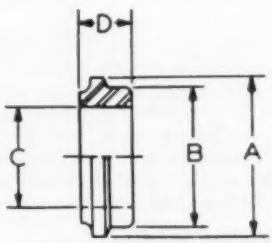


Fig. 13. To adapt smaller butt-diameters to larger diameter tubes, increasing bushings are used in building up drive lines.

To increase the butt diameter of stub ball yokes or weld yokes, chuck the bushing in the lathe on the shoulder with the long side facing out. Turn the outside diameter to a tolerance of .002″ to .008″ larger than the inside diameter of the tubing for a press fit to the tubing. Cut approximately on a 30° angle at the point of weld, Fig. 13. Turn the inside diameter of the bushing, while still in the lathe, to a tolerance of .002″ to .005″ smaller than the butt diameter of the weld or ball yoke.

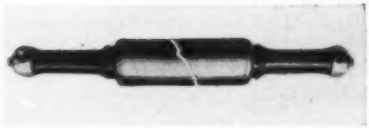


Fig. 11. Detroit ball type shaft sub-assembly for which length A is measured from the centerline of one ballhead hole to the centerline of the other hole.

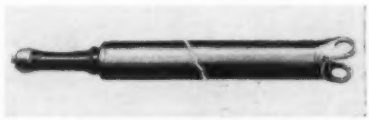


Fig. 12. Detroit ball-type sub-assembly for which length A is measured from the centerline of the stub ball yoke to the centerline of the ballhead hole.

Remove the bushing and assemble it to the ball yoke butt, using a babbit or brass hammer and tapping around the flat side of the bushing at even intervals. Then, follow the procedures outlined in the replacement of ball yokes (operations E-12 through E-26, page 53 of our January, 1958 issue).

A Little Care Will Prevent Spark Plug Breakage

Breakage of the top part of the spark plug insulator is almost always due to a mechanical blow, often due to the use of an improper wrench when installing or removing the plugs.

Splitting of the insulator tip can be caused by applying pressure to the center electrode when adjusting the gap or by an accumulation of deposits in the space between the electrode and insulator. If these deposits become packed tight enough, the expansion due to the heat can split the insulator.

The increasing bushings shown may be made by the shop from random lengths of suitable bar stock of the correct diameter. However, the tolerances mentioned in this article must be maintained.

A Outside Diameter	B Tube Pilot	C Inside Diameter	D Length	Tubing Increased
3″	2 7/8″	2 9/32″	7/8″	2 1/2″ x .109″ to 3″ x .065″
3 1/2″	3 3/8″	2 9/32″	7/8″	2 1/2″ x .109″ to 3 1/2″ x .065″
3 1/2″	3 3/8″	2 23/32″	7/8″	3″ x .134″ to 3 1/2″ x .065″
4″	3 7/8″	2 23/32″	7/8″	3″ x .134″ to 4″ x .065″
4″	3 7/8″	3 3/16″	7/8″	3 1/2″ x .156″ to 4″ x .065″
4 1/2″	4 3/8″	3 3/16″	1″	3 1/2″ x .156″ to 4 1/2″ x .065″

These are new *manufacturers' products*

HOW TO GET RUSH INFORMATION

If you want further information or literature describing the products shown in our "These Are New" pages, just use the handy Business Reply Card you'll find further back in this issue. Whether you want information on one or more of the products, all that is necessary is to mail this Postage paid card properly filled out to AUTOMOTIVE SERVICE DIGEST. Our Reader's Service Dept. will contact the manufacturers directly and see that you obtain the requested information as quickly as possible.

½" Drive Air Impactool

The Size 403 Model B, ½" drive automotive air Impactool recently announced by Ingersoll-Rand Co. features 15% more power and a new trigger mounted Select-Air regulator,

which enables the mechanic to quickly select the power needed for every job.

This five pound Impactool also features a simple-to-operate sliding reverse valve for easy and instant reversing, a protective rubber nose to seal out dirt, and a contoured handle to provide a comfortable tool to hold. The tool will handle work up to ½" bolt size, and the Select-Air feature makes it possible to run small nuts and screws without thread-stripping and breakage.

Measuring only 6" overall, with a 1⅜" side to center distance, the tool's efficient impact mechanism converts the full torque of the air motor into more powerful rotary impacts, making the toughest job easy.

(Use Reply Card for Further Information)

Firestone Adds New Lines

A complete line of mufflers, tail pipes, exhaust pipes and exhaust system accessories has been added to The Firestone Tire & Rubber Company's line of automotive parts.

Simultaneously with the announcement of the new exhaust system parts, the company also announced a new line of hydraulic brake service parts, which include master cylinder and wheel cylinder assemblies, stop-light switches and brake hose assemblies.

(Use Reply Card for Further Information)

Bus Towing Saddle

The Ernest Holmes Co. announces development of a new bus towing saddle which permits the operator of a heavy-duty wrecker to quickly pick up and tow large busses of the sceni-

cruiser type as well as busses of other types and large trucks.

With this all-new TS-55 bus towing saddle, an operator can easily attach the anti-sag chain of the towing saddle to a truck axle and quickly secure the vehicle for fast and safe towing. The new towing saddle is ruggedly constructed with lifting arms and sloping platform-type supports to prevent damage to the front end of the truck during lifting and towing operations.

Although primarily developed for use with a Holmes 650 or 850 wrecker, the equipment may be used with any wrecker of suitable capacity and design to handle such work. It is easy to install and may be readily attached to or quickly detached from the tail gate on the standard Holmes platform-type body.

(Use Reply Card for Further Information)

Torsion-Aire Height Gauge

The Bear Torsion-Aire Height Gauge, designed for 1957 model Chrysler Corporation cars, is also adaptable to the full 1958 Chrysler line.

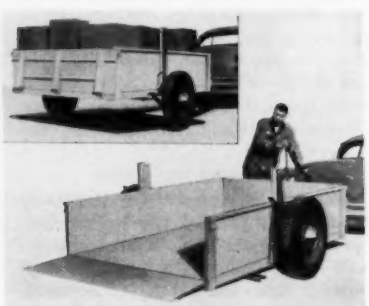
The gauge is easily installed, merely

snaps into place with spring clamps on the lower control arm bushing housing. The operator gets a direct height reading on both sides of the vehicle and is able to compare the two readings and adjust front-end height and level at the same time to manufacturers' specifications without removing the unit.

(Use Reply Card for Further Information)

Elevating Cargo Trailer

Easy Loader, Inc. announces an all-purpose trailer with a hydraulically operated bed which lowers to ground level for easy loading and then raises



to hauling position. It is unnecessary to detach trailer from hauling vehicle for loading or unloading, and the tail gate forms heavy-duty loading ramp as well as secure body closure. Rated at 2000 lbs. capacity, with ample safety factor, unit is of all-steel construction and weighs only 960 lbs.

(Use Reply Card for Further Information)

Hanson Power Timing Light

A new deluxe power timing light is announced by the Harvey E. Hanson Co. which works off either a 6- or 12-volt car battery without change-

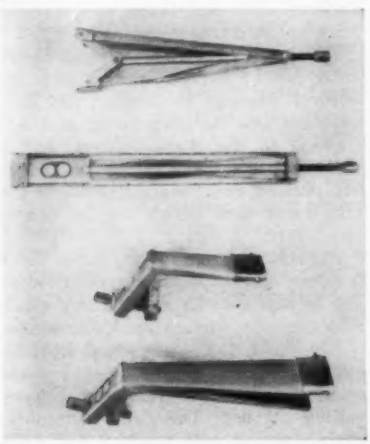
over or adjustment. Simple clips connect to battery and spark plug cable, and special circuit design is said to produce an extra sharp, extra brilliant light.

The chrome plated, die-cast case is ruggedly constructed to withstand everyday shop use . . . balanced design and comfortable pistol grip with handy on-off trigger switch assure easy-handling.

(Use Reply Card for Further Information)

Close Quarter Body Tools

A new set of close quarter body tools, especially designed to remove those dents in the "hard-to-reach" places on new model cars, has just



been announced by Associated Industries & Mfg. Co.

According to the manufacturer, the body man has complete control when using these new tools because the application of power is so gradual he can "feel" the metal unlock itself.

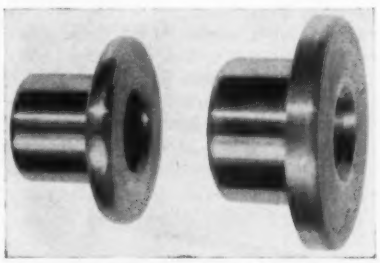
The set consists of four tools—the two close quarter jacks shown at the photo's top and the two expanding spoons at the bottom. Screw ends are operated with a ⅞" box end wrench or any ½" drive universal wrench. The small jack is 22" long—jaws are 1½" wide when closed, and open to 7½". Large jack is 30¼" long— 1½" closed and opens to 12". Small spoon is 14" long, ⅝" closed and opens to 4". Large spoon is 22" long, ⅝" closed and opens to 6".

The jacks are used to push out close quarter dents in fenders and doors. Spoons are used to take care of rear fenders, trunk lids, etc. During soldering, the spoon's metal dolly plate absorbs excessive heat, which is said to prevent metal buckling.

(Use Reply Card for Further Information)

Radii Cones for 1958 Cars

Barrett Equipment Co. announces two new radii cones required for machining front drums on the 1958 Pontiac and Chevrolet cars. These new radii cones are of the exact diameter



to assure proper seating in the shallow cups of the new bearings being used.

The cones fit brake drum lathes having a 1" arbor such as Barrett, Van Norman, Lempco and Ammco. Reducer sleeves are also available to fit ¾" and 11/16" step arbors.

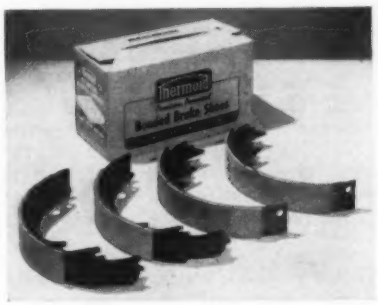
The No. 574-1 Radii Cone is required for the outer bearing cup and the No. 564-1 for the inner bearing cup of both Pontiac and Chevrolet when used with the Barrett B-500 DRUM-Dokter and other make brake drum lathes except Barrett B-21 series which require the No. 108-1 Radii Cone for the outer bearing cup and the No. 100-1 for the inner bearing cup.

(Use Reply Card for Further Information)

Thermoid Bonded Brake Shoes

New 100% dry mix brake lining compounds have been developed by Thermoid Co. in response to the growing demand for safer and longer wearing bonding segments. The new materials, identified as "MDB" segments, feature a dual friction combination of lining for use on Thermoid BM shoes.

The higher friction lining is used on primary and reverse shoes and the lower friction lining is used on secondary and forward shoes. According to the manufacturer, the use of a two friction combination tends to equalize the amount of work done by the various shoes and results in more even wear. Superior bonding characteris-



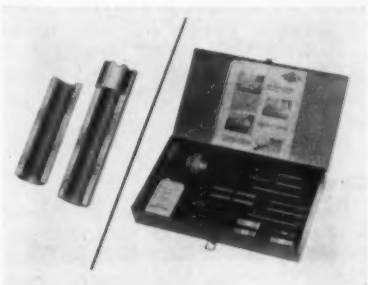
tics are reported for the new compound by laboratory studies, field surveys and customers.

Thermoid "B" shoes will continue to be bonded with CB material using processes which are carefully supervised to meet rigid specifications. CB lining, recommended for severe service such as that encountered with power brake equipment, is certified by the Pittsburgh Testing Laboratory. BX sets are furnished also with dual friction shoe combinations.

(Use Reply Card for Further Information)

Valve Guide Knurling Tool

A valve guide knurling tool is announced by the Cedar Rapids Engineering Co. which employs an entirely new method of bringing worn valve guides back to standard size—an operation which is also claimed to improve valve stem lubrication and



extend valve guide life. Integral valve guides can be restored to standard size eliminating the necessity of replacing all valves with oversize stem valves. Replaceable valve guides can be serviced in head or block with equal speed and ease.

According to company engineers, the new tool can be used on guides worn as much as .006" and can be used on most engine makes and models. The tool can be hand operated or powered by a standard ¼" electric drill equipped with a speed reducer. After knurling, a special piloted reamer restores the guide to standard size.

(Use Reply Card for Further Information)

These are new *manufacturers' products*

Right Angle Drill

Development of a new right angle drill (Model 3B RP-1) has been announced by the Milwaukee Electric Tool Corp. Weighing under 5 lbs., the drill is equipped with a right angle head which swivels a full 360° and locks in any position, allowing the

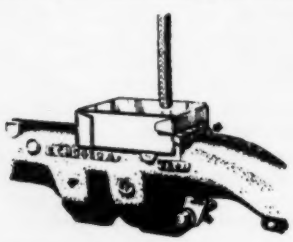
operator to drill in extremely cramped quarters and other areas that cannot be reached by regular straight-on drills. The right angle head is easily removable when necessary for straight-on drilling.

The right angle drill is adaptable to a total of eight other Milwaukee pistol grip type drill models. Housed in a lightweight cast aluminum body, the drill is powered by a 3 amp., ¼ h.p. Milwaukee-Built motor. The Model 3B is equipped with a ¼" chuck and operates at a no-load speed of 200 rpm. Comparable right angle unit drills with chuck capacities of ¼", 5/16" and ⅜", and drilling speeds ranging from 650 to 2500 rpm are also available.

(Use Reply Card for Further Information)

Choke Stove Kit

Brake Parts Specialty has developed a choke stove kit to eliminate the possibility of corrosive exhaust gases finding their way into the carburetor choke thermo-coil housing on 1955-'57



Ford products when the original heat tube (which passes through the manifold) becomes perforated.

The kit consists of an air-heating stove which mounts directly to the top of the manifold and an asbestos-covered pipe that carries the heated air to the carburetor. With this arrangement, heat for the carburetor choke is not obtained from the manifold passages, but from *outside* the manifold.

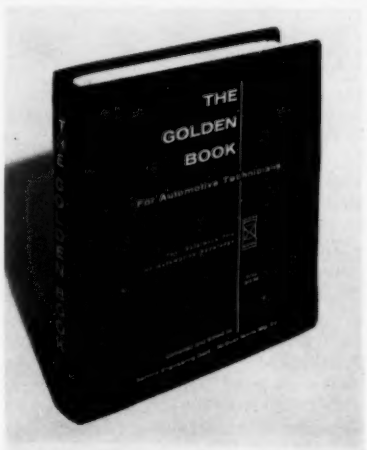
Detailed drawings available explain fully how to block the original choke-heating pipes and install the BPS choke stove and piping.

(Use Reply Card for Further Information)

New Mechanic's Handbook

A new automotive technical manual, *The Golden Book for Automotive Technicians*, is just off the press, edited and published by the Service Engineering Department of McQuay-Norris Mfg. Co.

The book contains more than 500 pages with more than 700 illustrations, and is divided into ten sections, each covering a different subject. Automotive engine fundamentals, shop operation and practices, business management, trouble diagnosis and



cure are some of the subjects covered. A special section contains all important specifications for all cars and trucks from 1929 to the present.

The book is presented in loose-leaf form, in a gold and black flexible simulated leather binder. The loose leaf feature is designed to encourage mechanics to keep up-to-date on new techniques and practices by providing a convenient place to file articles clipped from trade magazines.

(Use Reply Card for Further Information)

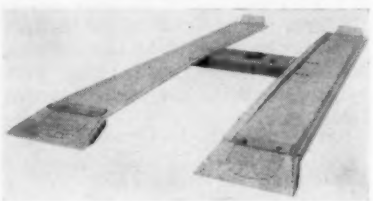
"Sure-Grip" Gear Lube

A special lubricant for Chrysler "Sure-Grip" differentials is announced by the Kendall Refining Co. Known as Kendall NS-MP Gear Lube, it has Chrysler approval under their specification MS-3534 and is the equivalent of Mo-Par parts No. 1879414 lubricant. It is also the recommended lubricant for limited or non-slip axles offered by American Motors, Lincoln, Studebaker-Packard and Willys. Features of the lubricant are its ability to prevent possible noise and, at the same time, properly lubricate the hypoid gears.

(Use Reply Card for Further Information)

Roll-On Automotive Lift

A new roll-on auto lift design is announced by Rotary Lift Co. which is said to provide more undercar clearance than any other roll-on type lift made. This clearance has been obtained by designing a long tapered in-



side runway flange. The taper begins from a commercial standard minimum 2½" flange height, 60" in from each runway end, and fades to a feather edge at the runway ends.

A car with only 3.6" of road clearance can be driven on this new lift without damage to muffler, gas line, or other low hanging parts, and, according to the manufacturer, ample clearance is assured for all 1958 models, plus an extra margin of safety for still lower cars, which may be due in the future.

In addition, runways have been widened and respaced to accommodate the largest cars as well as any small foreign make, such as the Volkswagen.

Approach ramps are fitted with an exclusive design, spring actuated wheel chock to positively prevent car from rolling off lift. The fully automatic chocks spring into position and lock when lift is only 6" off the ground and do not release until lift is within 2" of ground on descent.

The lift is available in airdraulic (semi-hydraulic) and fully hydraulic models.

(Use Reply Card for Further Information)

Say You Saw It In
Automotive Service Digest

Tests Single or Dual Contacts

Ease of operation, plus features which permit accurate testing of both single and dual contact distributors, is claimed for the new Sun Master Distributor Tester.

Completely AC powered, this new unit eliminates storage battery testing, charging and handling, and when

plugged into any 115 volt 60 cycle AC line is ready for instant use. Models are also available for operation on 115 volt 50 cycle and 230 volts, 60 or 50 cycle 3 phase AC.

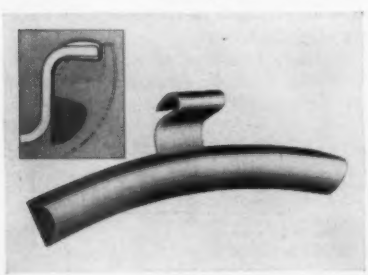
An improved drive with infinite speed selection from 0 to 3000 distributor r.p.m.; improved dwell meter circuitry and simplified instrumentation are some of the important features of this unit, available either as a bench or console model. A high speed model with an r.p.m. range of 0 to 4000 is also available for 115 volt, 60 cycle, single phase operation.

A complete set of adapter and vacuum fitting accessories, plus a spring tension scale and jumper lead are furnished with the unit. Full operating instructions are also included.

(Use Reply Card for Further Information)

Wheel Balancing Weights

On the 1958 Cadillac, the retaining fingers of the hubcap seat into the straight rim flange and thereby prevent the use of conventional type wheel weights.



In answer to this problem, Turner Mfg. Co. announces the completely new style of wheel weight shown here. The weights are packed in cartons of 25 each size and are available in sizes ½ through 3 ounces in ½ ounce graduations.

(Use Reply Card for Further Information)

Tire Changer

A new manually operated tire changer, designed to handle all size wheels from 12″ to 21″ in diameter, has been announced by the Coats Co.

The new machine, called the 3 - Star Tireman, embodies a bead breaker which works on a cam-action principal and is said to give more than 50 percent greater lift and 30 percent more leverage.

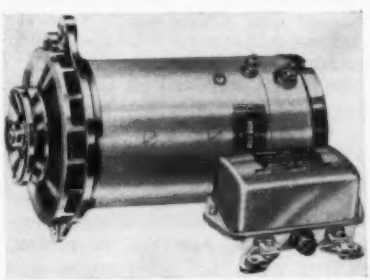
Bead loosener shoes on the machine are wide, steel arcs that gently force the beads while eliminating the possibility of damage. Both tubeless and conventional tires can be changed.

Another feature is a screw-type hold-down that requires only a twist of the wrist for fast, positive positioning and locking of the wheel to the stand. A reverse twist easily releases the wheel again.

(Use Reply Card for Further Information)

New Automotive Generator

Of special interest to operators of vehicles plagued by chronic battery trouble due to lack of charging current, is a new low cut-in generator



announced by American Bosch Division American Arma Corp.

The generator designated as the SSG and its companion regulator the SSR, are both heavy-duty units designed to withstand the rigors of severe service and are easily distinguishable from previous models by being painted gray instead of the conventional black.

Armature windings of the generator are bonded to their slots by a powerful new heat resisting plastic and are further supported by fiber-glass bands to improve their ability to withstand high speeds.

The slots between commutator segments are machined to unprecedented accuracy and field coils are encased in the new heat resisting plastic, which is said to provide greater protection against electrical or mechanical breakdown and permit better dissipation of heat.

(Use Reply Card for Further Information)

Heavy Duty Brake Fluid

Raybestos Division of Raybestos-Manhattan, Inc., announces a new Formula 48 Heavy Duty Brake Fluid that is said to meet or exceed every State requirements as well as the SAE

70R1 Heavy Duty Brake Fluid specification.

According to the manufacturer, this new addition was specifically formulated to resist the high temperatures developed in the braking systems of today's cars, trucks and buses.

Some advantages claimed for Formula 48 are: Won't boil or exaporate even after repeated high-speed panic stops, won't freeze up in sub-zero temperatures, lubricates brake cylinder parts, and will not cause rubber cup or hose deterioration.

(Use Reply Card for Further Information)

Plastic Rear Window Cleaner

The haze and cloudiness often found on the flexible plastic rear windows of convertible automobiles is said to be quickly removed with "Rez-N-Polish", a new anti-static, cleaner and polisher developed by Schwartz Chemical Co. Inc.

According to the manufacturer, "Rez-N-Polish" cleans all plastics used in cars and also removes haze and fine surface abrasions from plastic windshields and windows on boats and aircraft.

It is safe and easy to use, the manufacturer points out, because it is non-flammable, non-toxic, harmless to the skin and easily removed from the hands at clean up time.

(Use Reply Card for Further Information)

These are new *manufacturers' products*

Automotive Trim Assortment

Designed for all kinds of auto trim and upholstering installations, the Black & Decker Automotive Trim Assortment consists of a B&D No. 10 portable electric Positive Clutch Scru-

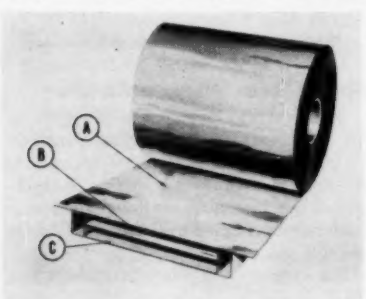
gun, and a variety of bits and sockets for driving and removing practically any type of screws and hex-head bolts encountered in this work.

Also included are a magnetic bit tip holder, 3 magnetic bits for nos. 1, 2, and 3 Phillips Head screws, a square driver adaptor, 3 hex sockets (5/16", 3/8", and 7/16"), and a bit and finder assembly for driving slotted head screws. With these attachments, all assembly work can be done in convertible top installation, panelling, upholstering, glass placement, and other auto trim work.

(Use Reply Card for Further Information)

Alfol Ceiling Insulation

A new kraft-backed aluminum foil insulation blanket for use on exposed ceilings is announced by the Reflectal Corp. The tough, rigid insulation



blanket, called Type 44F, consists of a base layer of the kraft-backed foil (A), a middle layer of aluminum foil (B) and a top layer of foil on kraft paper (C).

Inasmuch as aluminum foil reflects 95% of all radiant heat . . . the recognized cause of most heat loss or gain . . . the insulating efficiency of the aluminum foil, coupled with the rigidity of the new blanket, reportedly insures a completely permanent insulating surface. When used as an exposed ceiling, Alfol Type 44F provides a permanent and light-reflecting surface that requires no maintenance.

(Use Reply Card for Further Information)

Prestone Adds To Line

Eight new auto specialty products have been announced by National Carbon Co., Division of Union Carbide Corp., to meet the individual needs of the shopman or car owner. The new products include:

Auto Body Cleaner—A new type liquid cleaner designed to quickly and easily clean all types of automotive finishes and remove oxidized paint residue and foreign matter. The clean-

er is said to be excellent for preparation of the finish where separate cleaning and waxing is desired and is harmless to all finishes.

Rubbing Compound—A heavy duty cleaner in paste form, non-separating, to be used for removing surface scratches, blemishes, stains and foreign paint.

White Sidewall Tire Cleaner—A new quick-acting white sidewall tire cleaner said to be harmless to rubber, chrome, paint and other automotive finishes when used according to instructions.

Chrome Cleaner for removing rust, road film, tar and stains from chrome and stainless steel without scratching.

Chrome Protector—Especially formulated to retain a high gloss, and prevent rust and corrosion on bright metal automotive fittings. Is said to give outstanding protection against snow-melting chemicals.

Tar Remover—Quickly removes tar and road film without streaking or damage to automotive finishes.

Heavy Duty Brake Fluid—Conforms to the 70R1 standards specified by the Society of Automotive Engineers and will mix with all standard fluids of similar quality. Same quality used as initial equipment by automobile, truck and bus manufacturers.

Super Heavy Duty Brake Fluid—A premium fluid for premium performance in all heavy duty vehicle operation, specially designed to withstand extremely low temperatures and the high brake drum temperatures of the toughest operating condition. Exceeds the 70R1 S.A.E. specifications.

(Use Reply Card for Further Information)

New Mileage Minder

New features and improvements have been built into the new Mileage Minder, Model MM-200-MB, recently introduced by the Paser Manufacturing Co. Outstanding improvement is the addition of a newly developed device called Trouble Trap, a permanent-type magnet engineered to catch and remove ferrous metallic contaminants from the fuel stream.

The new Mileage Minder, in addition, has an all-metal fuel bowl, replacing the conventional glass bowl and giving the unit a 34% more compact size than earlier models. The metal bowl, states the manufacturer, makes the new Mileage Minder ideal for use on marine engines and on trucks in interstate use.

The Mileage Minder is a multi-purpose automotive motor accessory designed and engineered to improve performance in internal combustion engines by use of a pulsation dampening chamber which stabilizes the fuel flow at a smooth, steady level—but without reducing the fuel pump pressure determined as necessary by each car manufacturer.

Another function of the unit is to filter the fuel. It contains a sintered bronze filter disc which, claims the manufacturer, removes all dirt and never needs replacement.

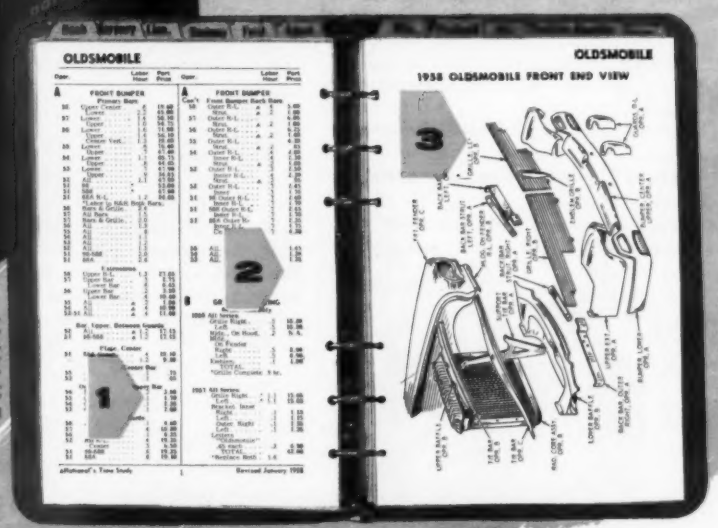
(Use Reply Card for Further Information)

Say You Saw It In
Automotive Service Digest

Use this "Master Gage" for Speed, Accuracy, Profit

The NATIONAL AUTO PARTS & LABOR MANUAL

The 3-in-1 master service



Sturdy Leatherette ring binder opens flat — index tabs for each car for fast reference — 4½" x 6⅝" easy-to-read pages.

Most Complete Service at the Lowest Cost $16.50

With this "master gage," you have *a precise check* on parts prices and labor charges — no guessing, no waste of time with catalogs and mathematics. For just $16.50 you have National's P & L Manual always at hand — the latest figures, illustrations, exploded views, including complete up-to-the-minute replacement-revision service that normally totals 15 mailings of more than 1300 pages annually.

Now! Separate Sections for Collision and Mechanical

For easier-to-use reference, National's P & L Manual is divided into two "fast find it" sections: (1) *Collision Section*—with all operations arranged in logical sequence. (2) *Chassis Mechanical Section*—covering all other repair services.

More than 50,000 Users

Year after year, in excess of 50,000 shops, garages, dealers and insurance adjusters subscribe for and rely upon National's P & L Manual. This nationally recognized "master gage" is their dependable authority for precise estimating and billing — and it is kept up-to-date constantly.

So if you want to be sure of *profits in your service and repair departments — in your body shop* — subscribe now for National's quick-reference, dependable P & L Manual. Complete satisfaction is guaranteed.

NATIONAL MARKET REPORTS, INC.
900 S. Wabash Ave., Chicago 5, Ill.
AUTOMOTIVE PUBLICATION SERVICES SINCE 1911

1 LABOR CHARGES

*Official factory time studies** expressed in hours and tenths, automatically figured at your hourly rate. No arithmetic — no chance for error. Covers all domestic cars.

2 PARTS PRICES

Factory list prices in the separate Chassis Mechanical Section cover all current makes, all models for the past 8 years — hardtops, convertibles and station wagons included.

3 ILLUSTRATIONS

For faster body shop estimating and billing, the separate Collision Section shows exploded views of front and rear suspensions, grilles, power steering — front sheet metal, including sub-assemblies and bumper — body diagrams, indexed by make.

* Where no factory flat rate exists symbol ▲ indicates that labor hours are based on National's field survey.

MAIL YOUR ORDER TODAY — 30-DAY MONEY-BACK GUARANTEE

NATIONAL MARKET REPORTS, INC., 900 S. WABASH AVE., CHICAGO 5, ILL.

Please enter our order for 1-year's service as indicated below, subject to your 30-Day free trial guarantee on National's P & L Manual:
Rates for United States and Canada only (Quantity Rates on Request)

- ☐ National Auto Parts & Labor Manual, Master Edition, including year's revision service $16.50
- ☐ Automotive Service Digest, one year—the country's foremost monthly magazine of shop know-how ..... $ 4.00
- ☐ (in combination with P & L Manual) ..... $ 3.50

☐ Check encl. ☐ We'll pay postman on delivery (plus charges)

Firm Name _____

Street Address _____

City _____ Zone _____ State _____

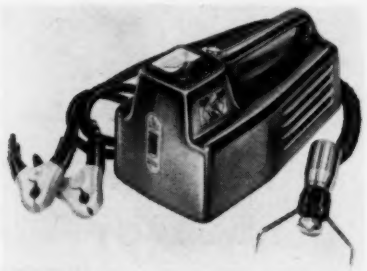
AD.

These are new *manufacturers' products*

"20-Second" Battery Tester

A new hand-carried battery tester is announced by the Marquette Mfg. Co. which is said to be the only "lightweight" tester available today with both accurate meter readings and a precise cell checker to provide foolproof analysis of individual cell conditions.

The unit is only 12½" long and



weighs just 14 lbs. It is entirely self-contained and requires no plug-in to an A-C source. To operate the operator just throws a switch to indicate whether a 6 or 12-volt battery is being tested. A sensitive, heavy-duty meter shows test results in "minutes of charge." For cell checking, the operator throws toggle switch to "cell tests," places special stiletto-pronged prod across each cell and obtains a true picture of individual cell conditions.

According to the manufacturer, use of this unit eliminates the need for open circuit and hydrometer tests, and gives a precise forecast of a battery's ability to generate and release power.

(Use Reply Card for Further Information)

Glass Tape Simplifies Repairs

Fibre Glass-Evercoat Co. announces a Fibreglass tape to use with its Formula 27 Plastic Fibreglass as a quick, easy, low-cost way of repairing rusted-out panels or spots.

To use, the Fibreglass tape, cut to proper size, is impregnated with pre-

mixed Formula 27 Plastic Fibreglass and applied to the cleaned area to be repaired. After quick hardening, the edges and any low spots are filled with additional Formula 27, a simple process, since the putty-like nature of the Plastic Fibreglass makes working to a smooth contour easy. When the entire patch is hard, it can be sanded and painted in the conventional manner.

(Use Reply Card for Further Information)

Wheel Cylinder Boot Assortment

Otto-Items is offering a handy wheel cylinder boot assortment consisting of 8 boots each of six popular

sizes to fit 98 percent of all passenger cars.

Also available is a complete stock of Tru-Torque Safety Cups plus Boot Assortment in a handy cabinet for an easy and economical way of handling inventory.

(Use Reply Card for Further Information)

Bushing Expander Mandrel

Sunnen Products Co. has added a new bushing expander mandrel to cover the .900" to .960" size range.

This new AL-900 Mandrel is designed for use with the regular AL-12 Expander, and is similar to others in the current Sunnen series of bushing expanders.

The AL-900 is recommended particularly for Ford, Mercury, and Lincoln con-rods using wrist pin size .912".

In use, the bushing is pressed into the rod eye, after which the rod is placed on the mandrel. The expander bit then squeezes the bushing into the rod eye, which is said to result in perfect contact and backing to prevent the bushing from working loose during engine operation.

(Use Reply Card for Further Information)

Portable Ignition Switch

A push-button switch that attaches under the hood to start, run and stop automobile engines without ignition keys, is now being marketed by the P & G Manufacturing Co.

An invaluable time and labor saver, the "No-Key" Switch is especially useful for starting, running and stopping the engine while working under the hood, and for either intermittent or continuous cranking of the engine without firing. (During continuous cranking, both hands are free for compression checks and other work

requiring two hands.) It is also said to be invaluable to parking lot attendants, service stations and mechanics when customers absent-mindedly retain keys.

The lightweight, flexible device features a new type single button control. All ignition functions may be performed from any position while working beside, over, or directly under the engine, which is particularly helpful when servicing an automobile on an overhead hoist.

This tool can also be used for locating blown fuses and broken circuits, checking electrical equipment, by-passing any switch, and may be used with an ammeter for checking generators and voltage regulators.

(Use Reply Card for Further Information)

When Spark Plugs Foul Prematurely Check Them for "Splashed Deposits"

A glance at the calendar tells us that Spring is just around the corner, and before we realize it, many car owners will be making preparations for their annual vacation trip—preparations which will include a *long overdue* tune-up, including a new set of spark plugs.

In this connection, a condition has come to light which should receive the careful attention of every shopman. Admittedly, it is rare, but *it can happen*, and if it does, here is how to handle it.

A rare case of "splashed deposits".

When the car leaves the shop, it runs fine . . . but after a few miles, the engine starts running rough again. Back comes the customer hot under the collar, and you remove the spark plugs to find that one or two of them are fouled.

The cause of this premature fouling is an *unusual* condition called "splashed deposits." The car had been in need of a tune-up for quite some time and had built up carbon deposits inside the firing chamber. There they stayed until your customer drove the car a few miles at high speeds. With the new plugs, adequate ignition was furnished to the cylinder and the temperatures inside the combustion chambers were raised back to normal. This, in turn, fluffed the deposits off the pistons and valves. At higher speeds the material stuck to the clean spark plug insulators, causing misfire.

This rare condition can develop in as few as ten or fifteen miles of fast driving after a badly needed tune-up. A simple cure is to clean and reinstall the spark plugs.

Chevrolet Revises Wiring Harness Used on Air Conditioning Units

On some of the early production 1958 air conditioning installations, the compressor clutch remains engaged at all times, whether the air conditioner is turned on or off. This results in unnecessary operation of the compressor, and, according to a recent Chevrolet service bulletin, the condition has been corrected in later production models by a revision in the air conditioning wiring harness.

To remedy the situation on those cars already in the field, without replacing the harness, Chevrolet suggests the following:

Cut the dark green wire leading from the compressor clutch where it enters the loom and tape the loom end of the cut wire. The dark green wire leading from the compressor clutch switch (mounted on the center control panel) should be cut at the point where it enters loom. Tape the loom end of the cut wire.

Connect the untaped cut ends of the two dark green wires using an added 16 ga. wire, paralleling the old harness. Solder the connections. This is extremely important due to the high current flow and sensitivity of the clutch to voltage drop. This connects the compressor clutch directly to the compressor clutch switch to permit proper operation.

Here's ALL YOU NEED to REPAIR your HYDRAULIC JACK!

JACK-PACK
HYDRAULIC
JACK REPAIR KITS & JACK OIL

JACK-PACK repair kits contain easy-to-follow instructions and all the packings necessary to make your jack work like new. And, be sure to use JACK-PACK hydraulic jack oil. It's the only oil with complete instructions for filling and bleeding your jack on the can.

ALL MAKES ALL MODELS

Save Money...Try a JACK-PACK!
- No more big jack repair bills.
- No more high freight charges.
- No more long equipment tie-ups.

Write today for free folder:

jack pack MFG. COMPANY
2115 No. Marianna Ave., Los Angeles 32, Calif.

ORDER FROM YOUR JOBBER!

THE PERFECT COMBINATION FOR SAFE PARTS CLEANING!

Kleerflo SUPER CLEANMASTER
MODEL 30

CLEAN PARTS 3 WAYS — SAFELY!
1. Continuous Flow Hose
2. Air Agitated Soaking Tank
3. "Super Power" Jet Air Gun

Refilters cleaning solution. Fire hazard reduced by self-closing cover and sparkless motor. Use for all parts including transmission and power steering units.

Kleerflo Hi-T M467 COMPOUND
SAFE! Powerful, penetrating action. Leaves film that prevents rust.

Kleerflo Hi-T DEGREASOL COMPOUND
SAFE! Fast drying, leaves no film, needs no rinse.

CALL, WIRE, WRITE TODAY FOR INFORMATION

America's Foremost Producers of Parts Cleaning Equipment
PRACTICAL MFG. CO.
2840 4th AVE. S., MINNEAPOLIS, MINN.

By STOKES TAX CONTROLS, INC.

Tax guide and business briefs

√ How to save taxes on investments

• MOST PEOPLE have large or small investments in stocks, bonds, savings accounts, etc. This article tells you how to minimize the tax on the income from these investments. The tax advantages of investments vary as widely as the other investment features. The discussion here gives no consideration whatsoever to the economic advantages of particular investments.

The method of ownership of stocks affects your taxes. Individuals are allowed to exclude the first $50.00 of dividends received. If your wife received $50.00 in dividends, you may have two $50.00 exclusions. You are also entitled to a 4% dividend received credit.

TRANSFERRING STOCKS TO MINORS

Suppose you could transfer stocks to your child which would yield him $750.00 in dividends. There would be almost no income tax if he had no other income, viz.:

Dividends Received		$750.
Dividend Credit		50.
		$700.
Dividend Credit (4%)		28.
		$672.
Optional Standard Deduction	$ 67.	
Exemption	600.	667.
Taxable Income		$ 5.

A gift tax might be incurred if you have previously used up your exemption.

If your child is under 19 or a student, you could still have your $600 income tax exemption if you furnish more than half his support.

An individual filing his return on the cash basis reports dividends received in the year received or available to him. A dividend check mailed on December 31, 1957 obviously could not be received in 1957 and is taxable in 1958. This may not be true in closely held corporations.

Corporations receiving dividends from most domestic corporations are allowed a credit of 85% of dividends received or 85% of income, whichever is less. However, the full 85% of dividends received is allowed as part of a net operating loss carry-over.

CAPITAL GAINS

If current income is not needed it is advantageous for most individuals to receive capital gains. Capital gains are taxed at a maximum of 25%. If your taxable income is less than $36,000 (joint return), capital gains are taxed at less than 25% because only half the long-term capital gains are included in income. If you want to take advantage of this tax saved, buy stock in growth corporations which have a record of rising values and low dividends. Be on the look-out for companies with large earning yields and low dividend yields.

If you have held a stock more than six months, you can convert a dividend into a capital gain by selling just before the price is quoted "ex dividend" date.

PROFITING FROM THE MARKET

Of course, it is possible to profit from market swings if you have the time and the experience. For instance, American Telephone & Telegraph Co. has paid $9.00 dividend for years. For as far back as you can remember, the market price has not varied more than $9.00 every year. You only have to know when to buy and when to sell.

Some companies have a record of paying nontaxable stock dividends. Frequently, the price of the stock does not decline in proportion to the dividend distribution. Where nontaxable stock dividends are issued the original cost of your previously acquired stock is prorated over the old and new stock. The purchase of low cost stocks which regularly pay stock dividends can be profitable. First, verify the fact that the past policy of the company will be continued and that it represents a real growth opportunity.

FAVORABLE TAX CONCESSIONS

There is considerable growth potential in oil and gas producers because of favorable tax concessions. Producers of oil and gas are allowed depletion of 27½% of gross receipts and they can charge exploration and drilling costs as expense.

Stockholders of life insurance companies receive a tax break also. Profits from the insurance division are not taxed and profits on investments are taxed below the regular corporation rates. The death rate is decreasing. Income is being compounded by reinvestment of earnings. There are few life insurance company stocks open to public investment. The price of such stocks in the last 10 years has risen 6½ times as fast as other stocks in the general trend index.

Investors interested in long-term capital gains are being attracted by certain Canadian investment companies. The companies referred to are registered in the United States and subject to control of the Securities and Exchange Commission. These companies pay no U.S. Tax and Canadian Tax is reduced where the company is owned by nonresidents. Capital gains are not taxable in Canada. U.S. investors incur tax only when they sell their stock.

TAX EXEMPT BONDS

There are capital gains opportunities in bonds selling at a discount. If bonds are issued after December 31, 1954 at a discount, you cannot treat the profit as capital gain. This rule does not apply to old bonds or bonds issued at par but purchased at a discount.

Tax exempt bonds look like a good saving for anyone regardless of tax bracket. Of course, the inflationary trend in our economy does not inure to these bonds because they mature at a specific amount. Some tax exempt bonds are conservative investments. Some are highly speculative. Tax exempt bonds are obligations of a state, territory, or any political subdivision or the District of Columbia. Also, the bonds of the local Housing

Authority issued under Section 5 (e) of the U. S. Housing Act of 1937 are exempt. Let's assume that can be reasonably expected. So an investment of $10,000 would yield $300 free of tax. A married man investing in fully taxable industrial bonds at 4% would retain from ⅔rds to ¼th of the income depending on his tax bracket as shown below:

Income Bracket		$10,000 4% Bonds Fully		Retained After
Amount	%	Taxable	Tax	Tax
$10,000	26	$400	$104	$296
20,000	38	400	152	248
30,000	47	400	188	212
40,000	56	400	224	176
50,000	59	400	236	164
75,000	65	400	260	140
100,000	75	400	300	100

The juggling of investments is not for amateurs but you should be familiar with the tax problems and know that the impact of taxes vitally affects the economic advantages of your investment.

Automotive Clinic . . .

(Continued from page 6)

to A on the voltage regulator.

The only other reason that we can see for excessive current through the points is that the voltage regulator may not control the voltage as it should, which allows too much current to flow through the points. Be sure that there is no chance for leakage of current from the wire to the battery side of the coil across to the distributor side. After the engine is well warmed up, put a voltmeter from the battery side of the coil to ground to check the voltage. Watch it for at least five minutes. It should not read above 7.4 volts. Be sure the battery is well grounded and that the generator field ground is through the regulator only.

Too Much Oil in Crankcase

Instead of using oil, we have a 1951 Olds 98 in our shop on which the oil level builds up after an oil change of the required 5 quarts of oil.

To correct the situation we have installed a new fuel pump, dropped pan and cleaned oil screen, changed dip stick and checked cooling system for leakage (none found).

This car gives an indication of using oil, especially when accelerating from the bottom of a long hill (blue smoke), but we only have to add one quart during 2,000 miles of operation. Yet after the first 1,000 miles the oil level on the dip stick is approximately one quart over the full mark.—*H.J.P., Burgetstown, Pa.*

Answer: Well, we are certain that this engine cannot manufacture oil or gasoline, so the only thing that could possibly raise the oil level in the crankcase (if it is actually raised) is water—water from the cooling system or possibly from a build up of condensation. In regard to the latter, we have run into a few cases where enough moisture has condensed in the crankcase to raise the oil level appreciably.

Does this car make a lot of short runs and cold starts? Another possibility is excessive fuel going through the carburetor and getting past the rings to get into the oil pan. How is the gasoline mileage? It might pay to put in a 180° thermostat, and if condensation is the cause of the trouble, use of an engine heater while the car is in the garage to keep the engine temperature above the dew point may help.

Engine Vibrates

I recently installed a factory rebuilt engine in a customer's 1953 six cylinder Ford. Upon checking the job I found that the engine vibrated badly at about 900 r.p.m., when standing in neutral. I removed and replaced the clutch with an all-new unit, but it still vibrated, checked flywheel runout and considered it to be within limits. *(Continued on following page)*

Barrett Now Offers...
COIN OPERATED
BRAKE DRUM LATHES
Barrett DRUM Dokter
Electrically Coin Operated Meter does the trick...
Increase your profits...you pay only on the drums machined—at an approximate cost of 30 to 60 cents per drum. (Passenger Car)
Available on B-500 DRUM-Dokters, all Models—with meter installed at factory...ready to operate.
See your Barrett Jobber Immediately...
or Mail Coupon
You...
Reduce your drum machining costs
Can machine drums, day . . . night . . . Saturday or Sundays—when Jobber shops are closed
Will machine 7 to 14 times more drums as the Lathe is convenient and it merchandises Brake Service
Eliminate lost time on drums sent out for machining
Realize greater profit from Drum Machining. Profits alone will amortize purchase of complete Brake Equipment in a short period of time
BARRETT EQUIPMENT CO. B-3
2101 Cass • St. Louis 6, Mo.
Please send details on Coin Operated DRUM-Dokters.
Name
Address
City State
Signed
BARRETT EQUIPMENT COMPANY

Clinic . . . CONTINUED

Next I replaced the flywheel with a new one, as well as the front vibration damper and new fan blades . . . but it still vibrates. Valves were reground, and head was resurfaced (.011" removed). Shims were installed under the valve springs to insure proper tension . . . but the vibration is still there at about 900 r.p.m. (or 25 to 30 m.p.h.) when driving on the road.—*R.V.C., Benton Harbor, Mich.*

Answer: It appears as though you have a set of pistons and rods in the engine that are not of equal weight, which could be causing the vibration.

About the only way this can be checked is to remove the pistons and rods, take the pistons off the rods and weigh each one separately. A variation of over half an ounce would be excessive. Also be sure the engine mounts are tight when the engine is installed.

Raising Compression Ratio

We have been approached by a customer who wants us to increase the compression ratio of a 1955 Mercury Montclair from the present ratio of 7.6:1 to 9:1 or approximately so. How much would we have to grind off the '55 head to get this higher ratio, or could we use the 1956 cylinder head which, I believe, has a compression ratio of around 9:1?—*N.F., Des Moines, Iowa.*

Answer: Apparently the 1956 head will fit the '55 engine, but since the 1956 engine has a stroke of 3.44" as against the stroke of 3.30" of the '55 engine, we wonder what the effect on compression ratio might be.

According to specs the 1955 head standard compression ratio is 7.6:1, as you mention. Since this is the regular head for the engine, you possibly could grind off about .080" and thereby boost the compression ratio close to the 9:1 your customer wants.

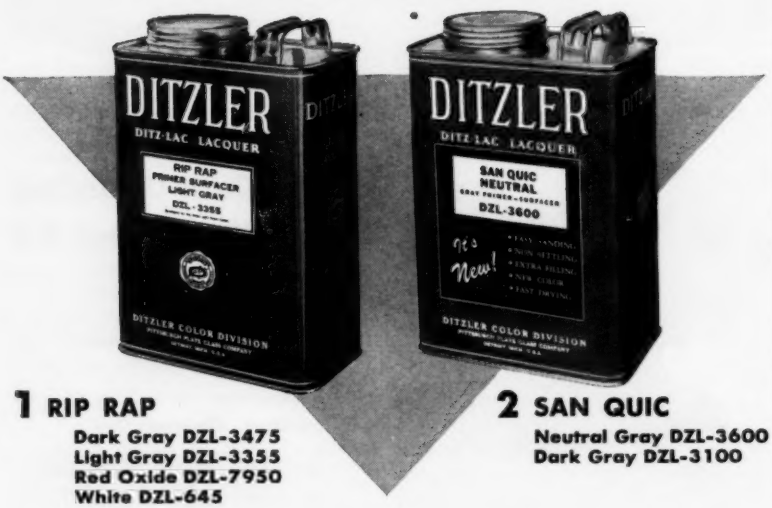
What's Your Guess?

In taking over a shop that has been going for a good many years and while checking over equipment, tools and other assets, we came across a wooden box which contained what looked to us like a tire pump about 3 in. in diameter and 16 in. long. It has a heavy wooden handle on the plunger rod, with a pressure gauge on top. Also, the box contained a 45 deg. elbow and a collection of pipe nipples and sleeves. Apparently the fittings are screwed into the bottom of the "pump" cylinder. We are wondering if this might be an old type of compression tester. Maybe you or some reader might recognize this equipment from our description.—*T.W.H., Birmingham, Ala.*

Answer: Digging into our bag of old tricks, if memory serves us right, we believe what you have inherited is a "Hammett Motor Tester" made some 30 or 35 years ago. This unit was a compression tester, but also was used to check engines for piston pin, rod and main bearing knocks without having to run the engine or disassembling it. In other words, the user, by working the handle of the device could make a pin, bearing or piston knock by introducing compressed air through the spark plug hole with the tester.

This unit located leaky valves and leaky rings in much the same manner as modern types of cylinder leakage testers do, excepting that the latter take their air supply from the shop's air compressor.

2 GREAT PRIMER SURFACERS in 6 colors for every refinishing need!



1 RIP RAP
Dark Gray DZL-3475
Light Gray DZL-3355
Red Oxide DZL-7950
White DZL-645

2 SAN QUIC
Neutral Gray DZL-3600
Dark Gray DZL-3100

They're Better 7 Ways!

1. Saves you money! High solid content gives you more film-forming materials. Fewer coats necessary. Free from shrinkage.

2. Saves you labor! Easy sanding—requires less work to get a smooth surface. Water sands with 320 paper and dry sands with 360. No clogging of paper.

3. Gives you first class appearance! Excellent hold-out of lacquer or enamel colors over Rip Rap or San Quic produces an outstanding job with maximum gloss of final finish.

4. You get superior performance! No splitting or chipping around the feather edge. Feathers out beautifully to a mere shadow.

5. Your jobs will stand up longer! Detroit and Florida exposure tests show Ditzler's superiority in durability under the most severe weather conditions.

6. Saves you time! Famous for non-settling. No time wasted in laborious stirring. Stirs easily even after thinned material has stood for hours in gun cup. Does not settle hard in can.

7. Handles easily! Convenient easy-to-pour cans. Oblong type with LARGE opening—no waste in pouring.

Ask your local Ditzler jobber for these outstanding undercoaters and see for yourself how much better they are.

Ditzler Color Division, Pittsburgh Plate Glass Company, Detroit 4, Michigan

DITZLER®
PAINTS • GLASS • CHEMICALS • BRUSHES • PLASTICS • FIBER GLASS
PITTSBURGH PLATE GLASS COMPANY
IN CANADA: CANADIAN PITTSBURGH INDUSTRIES LIMITED

WHEN CHANGING YOUR ADDRESS

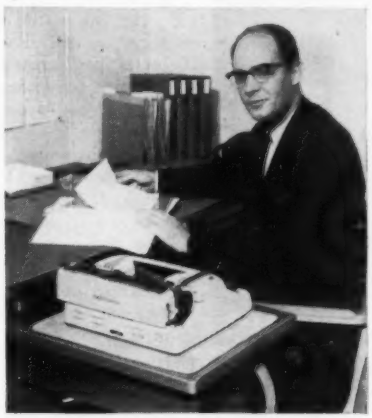
Please notify us 5 weeks in advance. Supply us with both your old and new address, including address label from current issue if possible. Copies we mail to your old address will not be delivered by the Post Office unless you pay them extra postage. **Mail address changes to Circulation Dept., Automotive Service Digest, 900 South Wabash Ave., Chicago 5, Ill.**

George A. Whittington, Managing Editor Of Automotive Service Digest

• IN EXPANDING the editorial services of this publication we are proud to announce the appointment of George A. Whittington as Managing Editor of AUTOMOTIVE SERVICE DIGEST.

A veteran of 15 years in industrial publishing and advertising, Mr. Whittington is ideally qualified in the rounding out of our editorial staff. He was founding editor of three nationally-known publications: INDUSTRIAL LABORATORIES, INDUSTRIAL SCIENCE AND ENGINEERING, WESTERN ELECTRONIC NEWS and also was assistant editor of LIGHT METAL AGE.

Mr. Whittington has travelled throughout the United States and Canada on editorial and public relations assignments as well as publishing activities. Many of his unsigned feature articles in INDUSTRIAL LABORATORIES were cited in the book "Annotated Bibliography on Research Administration" by Prof. George P. Bush of American University, Washington, D. C.



George A. Whittington

Whittington authored the booklet "Scientific Manpower—America's Most Precious Resource," published in 1953 by Industrial Laboratories and widely circulated in industry, government and educational circles.

For several years he was Public Relations Specialist with Aubrey, Moore & Wallace, Advertising, Chicago, assigned to the Industrial Power Division account for International Harvester Co.

Mr. Whittington's professional affiliations have included American Society of Metals, American Association for Advancement of Science, Society of Business Magazine Editors and American Institute of Management. He majored in creative writing and public relations at Northwestern University.

The publisher of ASD and your editor are proud to make available to our readers the editorial background and contributions of our Managing Editor.— *Ben Ikert, Editor*

Lincoln Uses Latex Primer

The unitized bodies of the '58 Lincoln are now being primed by dipping them into this 9,000 gallon tank of latex primer paint so as to afford better corrosion protection as well as eliminate the fire hazard present in dipping operations involving solvent-thinned materials. It is said to be the first time an automotive manufacturer has made such use of water-emulsion paints.

"Ping" No Longer Guide on Timing

The days of "seat of the pants" ignition timing have passed, according to a service tip from the engineers of Champion Spark Plug Co. On modern cars it's no longer practical to set spark advance by sound, since the engine may be actually detonating (knocking) long before you can hear it. This is especially true in truck engines where large masses of iron plus compressor and exhaust noises smother the spark knock.

The danger of detonation, which can result in serious engine damage, is good reason for accurate timing adjustment with modern equipment.

Flightomatic Transmission Service Tips

When servicing Flightomatic transmissions, if a front or rear clutch failure is encountered, the clutch lining particles are exceedingly hard to wash out of the transmission. If all particles are not cleaned out thoroughly, Studebaker-Packard states that sticking valves are usually the result. Therefore, they stress the importance of disassembling and thoroughly cleaning the transmission, including:

(a) Both of the clutch operating pistons and cylinders.

(b) All of the passages in the shafts.

(c) Disassembling and carefully cleaning both front and rear band operating servos.

(d) Draining the oil from the converter as well as the transmission and discarding it.

All remaining parts, including the control valve assembly, pressure regulator assembly and governor should also be thoroughly cleaned.

FREE! informative, illustrated literature covering Basic Automotive Testing Equipment. Write for your copy today.

HARVEY E. HANSON·CO.

183 W. COMMERCIAL ST. PAW PAW, MICH.

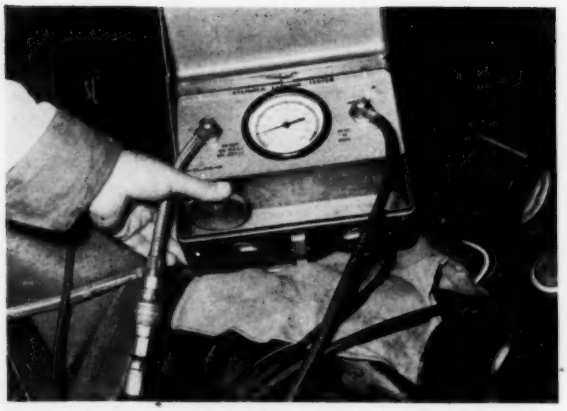
Are you trying to get by with old equipment when you can now afford new high quality test equipment at Hanson's low prices...

Name _____

Address _____

City _____ State _____

Send me free literature by return mail.



Trouble in cylinders is pin-pointed by the cylinder leakage test, which reveals whether the low-compression is due to the intake valves, exhaust valves, rings or head gasket.

The Dynamometer . . . (Continued from page 25)

meter will help to identify the source. Of almost equal importance is the opportunity to bring out previously unsuspected faults, so that corrective service can be recommended before actual failure takes place.

The tachometer and dwell meter should be hooked up before starting the dynamometer test for ignition faults. At the same time a visual inspection should be made of the primary and secondary wiring, checking the primary lead to distributor, battery cables, battery connections, hot lead to starter solenoid, cracked or worn high tension wires, dirty distributor cap and coil tower, rubber spark plug covers, etc. Any possibilities of trouble should be noted, but no changes made until they can be proved to be at fault, thus eliminating guess work as to the trouble source.

CHECK IGNITION UNDER FULL POWER

To make the test, load the dynamometer and increase throttle opening until the speed is 25 mph at full throttle, or 1200 rpm. Note the horsepower and observe any knocking, roughness, steady or intermittent misfiring as the engine warms up. Also note the cam angle or dwell. This should be between 35° and 38° on six cylinders engines or 27° to 31° on eights, and should be checked with the actual engine specifications. The load on engine should next be reduced to allow the engine to speed up to 40 mph or 2000 rpm with full throttle, noting any of the faults mentioned above if they become evident. Reduce the throttle opening with the dynamometer load unchanged until the vacuum gets up to 10″ or more. Note the cam angle and reduction of any tendency to misfire which might have been noticed at full throttle. Full throttle puts the greatest strain on the ignition system, so that trouble will show up at this time where it might not under less strenuous operating conditions.

This procedure has now checked the ignition system. If the engine is not misfiring the system is functioning satisfactorily. Inspection will give information as to breaker point condition and the voltmeter will quickly check for unwanted voltage drops in the primary circuit, if any. The voltmeter or coil tester can also be used to see that the high tension polarity is negative as it should be. Any work or new parts that are needed should be taken care of before the final operation of timing the ignition, is performed.

The timing should always be done with the engine water temperature between 165° and 175°F. and should be set to obtain peak power with passable knock intensity. It should never be set for more advance than will give peak power regardless of knock intensity. Knock or maximum power is the advance limit for ignition timing.

In the actual timing operation, the distributor locking screw is loosened just enough so that the distributor can be tapped around with a light hammer to adjust, yet will not move by itself while the engine is running. The engine should be operated at full throttle at 25 mph or 1200 rpm. Retard the spark by moving the distributor below the point of knock or until the horsepower meter indication drops noticeably. Next advance the distributor gradually and observe horsepower indication. After each movement wait for the reaction to reach the power meter. The dynamometer flywheel should be disengaged. The horsepower gains will be less with each degree of distributor movement as the maximum power output is approached. Soon the power will drop slightly, which means too much advance. Gently retard the distributor until the power just drops slightly. This is the farthest retard position for maximum power, and the distributor should be locked in this position. The timing should always be set somewhat on the retard side of maximum power for smoothness at idle and to protect against the development of knock as carbon may accumulate.

DON'T CONFUSE PREIGNITION AND DETONATION

If the engine cannot be timed for maximum power without objectionable knocking, advance the distributor slowly from an abnormally retarded position to a point where a light knock is heard while standing near the engine. Always advance to the final setting when the engine is knocking. Retarding out a knock once it is started results in later timing than is required to keep knock from starting because combustion chambers become abnormally hot from a knocking condition. Remember that this setting is with wide open throttle so that a slight knock under this condition will not be objectionable or dangerous to the engine when operating under normal road conditions.

Be alert for preignition, which is a distinctly different

Carefully recording the results of the various tests—with the vehicle under load or with the engine idling—is the only way to get a true performance record from which to prescribe the necessary service work.

kind of knock from normal detonation, and is caused by firing of the compressed fuel-air mixture BEFORE the spark occurs. This can be detected at full throttle usually at low speed (1200 rpm or 20 to 25 mph) but sometimes as high as 40 mph. It begins to come in as the plugs, exhaust valves or carbon points on the head or piston reach maximum heat. If on turning off the ignition the engine keeps on firing momentarily, or knock-fires on turning off at idle, preignition is occurring. This would indicate that spark plug heat range should be checked, and/or a valve job or carbon cleaning job be considered. Leaky valves might also be indicated since a poorly seating valve has low heat transfer and the passage of hot gases may raise the valve head temperature to the fuel ignition point.

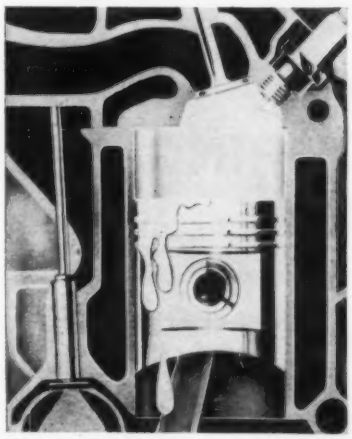
A VALUABLE COMBINATION

With the gradually increased use of the automotive oscilloscope, we have a combination—the dynamometer and the oscilloscope—that is the most valuable diagnosis means that the service trade has ever had available. The oscilloscope in itself is a valuable tool, but in some cases obscure troubles in the ignition system only would show up when the engine is loaded which would require a road test. With the dynamometer used to load the engine, any defects in the ignition system will be evident at once.

The investment in a dynamometer and the oscilloscope is fairly sizeable, but the results that can be obtained by the combination will open opportunities for profitable diagnosis and corrective service that will make the investment pay out in a very satisfactory way. It should appeal to shops where true expert service is offered, and prices are high enough to justify complete and honest diagnosis and trouble shooting.

Spark Plugs and Oil Dilution

Oil dilution, the thinning of oil from raw gasoline which washes past the piston rings, is generally attributed to a clogged air cleaner, an incorrectly adjusted carburetor or a faulty automatic choke.



An exaggerated case of oil dilution.

However, there is another serious offender—a misfiring spark plug. When a spark plug fails to fire, some of the raw, unburned gasoline works past the piston rings, washing away the lubricating oil on the cylinder walls. As it goes into the crankcase it further dilutes the crankcase oil.

Not only does this dilution deprive rings and cylinder walls of vital lubrication, but it reduces the protective value of the oil in the crankcase thus increasing valve and bearing wear.

* * *

The average life of motor vehicles has doubled since 1925, when 6.5 years was the typical age of vehicles when scrapped. Today, the usual age of cars headed for the junk heap is 12 years or more. Accumulated mileage during a motor vehicle's lifetime has quadrupled—from 25,750 in 1925 to 110,000 today.

Calendar of Automotive Events

1958

April 5-13—1958 International Automobile Show, New York Coliseum, New York, N. Y.

April 23-25—1958 Spring Booth Conference of Automotive Wholesalers and Manufacturers Representatives, Bon Air Hotel, Augusta, Ga.

May 11-14—Automotive Engine Rebuilders Association Convention, Sheraton-Park Hotel, Washington, D. C.

May 26-27—NAPA National Business Conference, Sheraton Park Hotel, Washington, D. C.

June 25-29—IGO-America 1958 Convention, Statler Hotel, Los Angeles, Calif.

Dec. 12-16—Automotive Warehouse Distributors Assn., Inc., National Convention, Muehlebach Hotel, Kansas City, Mo.

1959

Jan. 17-25—Chicago Automobile Show, International Amphitheatre, Chicago, Ill.

●

Check Housing Filler Plug Clearance On Reports of Noisy Twin Traction Axle

Studebaker reports that there is a possibility of noise in the twin traction rear axle which is created by interference between the housing filler plug and the ring gear; especially if the plug has been removed and installed a number of times so that it seats deeper than normally.

If this occurs, it is suggested the plug be removed and the end ground off to provide the necessary clearance.

"$3,969 IN 1 MONTH Repairing Radiators!"

"My Inland equipment and the wonderful job it does has attracted nearly a $4,000-a-month volume!" — Neyland's Auto Paint & Body Works, Baton Rouge, La.

"We are going at the rate of $16,000 a year!"—McRill Auto Service, Twin Falls, Idaho. "$13,904 in 9½ mos.!"—McCain-Richards, Monroe, La. Many do as well or better. Why don't YOU get into this Big Income business?

20,000,000 Radiators Need Servicing Yearly! And with today's engine power increased, and the cooling capacity decreased, radiators will require more service than ever before! Here's a business with a growing future!

Inland, the industry's leader, offers equipment, training, Pays-For-Itself purchase plan—advertises nationally to attract radiator servicing business to Inland-equipped shops. Mail coupon!

INLAND MFG. CO.
1108 Jackson St., Dept. AD-3, Omaha 2, Nebr.
World's Largest Manufacturer of Radiator Servicing Equipment
"SOLD EXCLUSIVELY BY MAIL"

FREE TRAINING SCHOOL
Factory school trains you or your man quickly: Cleaning, repairing, recoring, pricing, everything! FREE to Inland customers.

WRITE INLAND MFG. CO., Dept. AD-3 1108 Jackson St., Omaha 2, Nebr.
Please send new free book, "Blue Print For Profits."

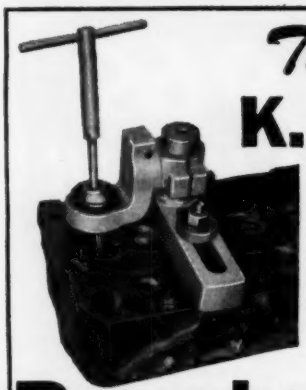
FIRM _____
(PLEASE PRINT)
ADDRESS _____
CITY _____ ZONE ____ STATE _____
BY _____ TITLE _____
If dealer, make of car sold _____
Are you now operating a radiator dept. ☐ Yes ☐ No

Rajah
HAND CRIMPING TOOL

HAND CRIMPING TOOL
Order from Your Jobber or Direct from Us. Send for Circulars and Prices

It Cuts
And Strips
And Also Crimps
Rajah Terminals to ignition cable without the use of solder or any other tools

The Rajah Co. 35 VERONA AVE. NEWARK, N. J.



The New
K. O. Lee Valve Guide Reaming Sets

Designed to service late model engines which have valve guides cast as part of the cylinder head. In this new type head, it is the valve which has to be replaced. This is accomplished by reaming out the valve guide for oversize stem valves. Most of the engine and valve manufacturers now offer at least three sizes of oversize valves.

The Lee Reamer Guide provides a true alignment with original guide bore using Lee Self-expanding pilots. The reamer is held rigid with reaming bushing during reaming operation. Simple to operate and extremely accurate.

Special sets available to service Ford, Mercury, Lincoln, Chevrolet, Plymouth, Dodge, DeSoto, Chrysler.

R55 Reseater Power Drive adapts to these valve guide reaming sets.

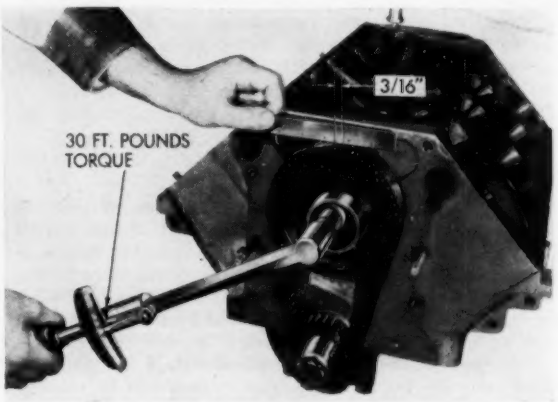
Clip ad to your letterhead and send for Literature.

K. O. Lee Company, Aberdeen, S. D.

Replacing Timing Chains

● HERE IS A SIMPLE check you can make which will accurately indicate whether a timing chain should or should not be renewed when you're doing an engine overhaul job.

With the engine tight enough so it won't crank over during this test (or blocked against turning), apply 30 lbs. of torque on the camshaft. Identify a spot on the



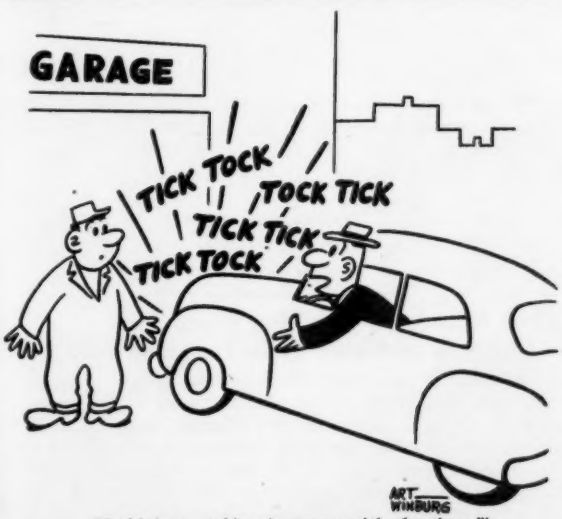
Manner of checking timing chain play. (Illustration courtesy Plymouth Division, Chrysler Corp.)

chain, and hold a steel scale in position, as illustrated. The chain is okay for continued use, unless the freeplay exceeds 3/16".

Chains don't stretch. What actually happens is that the pins and links wear. Or, more commonly, they corrode in cars where owners are not careful to change oil at regular intervals, depending on the nature of their service. If, as a consequence, the oil becomes a bit acid or there is water or dilution in it, the hard steel pins and the steel links of the chain not only wear, but are etched. And so, for convenience, we do say that the chain stretched.

But when the looseness allows more than 3/16" of play in the camshaft, you'd better have new parts in the drive, or the valve timing will be pretty sour. And so will engine performance—and perhaps the customer.

So when you're overhauling an engine, or have the timing cover off, check the chain. It can easily lead to a little plus profit and a little plus prestige.



"I think something is wrong with the timer!"

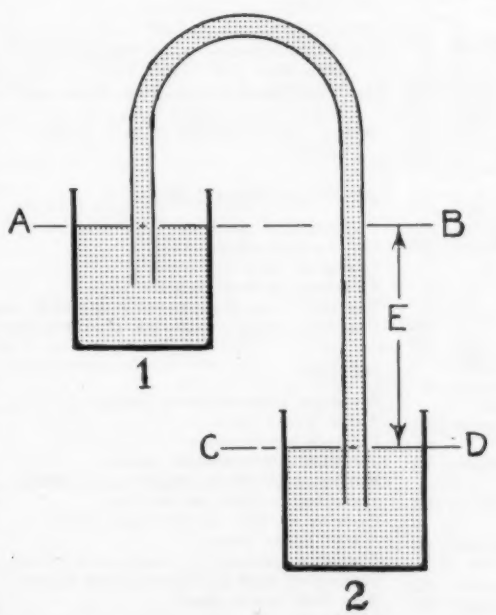
BRUSHING UP ON THOSE EASY-TO-FORGET THINGS

Refresher course

The principle of the siphon

● **ESSENTIALLY, A SIPHON** consists of a bent tube which has arms of unequal length. The siphon is used to carry a liquid over a small elevation to a lower level.

In laboratories, glass siphons are used extensively for drawing liquids from bottles. Countless other uses are made of siphons and so it may help to know how and why a siphon works.



If a siphon tube is filled and placed as in the illustration, the liquid will flow out of the container 1, and be discharged at a lower level in container 2. The force which makes it flow is the weight of the liquid (column E) which is between the liquid levels AB and CD.

If the liquid level CD is raised to level AB, this moving force becomes nothing and the liquid ceases to flow. If the liquid level CD is lifted above AB, the liquid flows back into container 1.

Thus, a siphon works as long as the free surface of the liquid in one container is lower than that of the liquid in the other container. Atmospheric pressure keeps the short arm full.

Sensational NEW
FAST
DRYER
that makes
PAINT JOBS
Profitable!
Three switch control operates all 7 bulbs on any combination.
TRIPPE
SCORES AGAIN
with
NEW "IR-7"
Effective in Drying The new Epoxy resins.
Here's a fast action infra-red dryer on a stable 25" circular base with MAN SIZED Control Knobs and Handles for quick adjustments. Heavily wired for 115/130 Volts.
Call Your Jobber TODAY
or Write us NOW!
TRIPPE MFG. COMPANY, Dept. C-3
133 N. Jefferson St., Chicago 6, Ill.

Rough Handling Main Cause Of Broken Caps and Rotors

In answer to the frequent question, "What causes distributor caps and rotors to break," Electric Auto Lite states, in a recent bulletin, that most breakage of caps and rotors is caused by mechanical means. Usually the cap is broken by being struck either through carelessness or by severe rocking or vibration of the engine.

If the cap is not seated properly (usually due to interference by the primary lead) the rotor can strike the terminals and break both the cap and rotor. Occasionally a leaking vacuum advance diaphragm can allow fuel vapors to collect in the distributor, nd when these vapors become ignited, the cap is forced off, often resulting in breakage.

A rotor can easily be broken by forcing it on the cam in spite of some restriction.

* * *

Automotive electrical systems have nearly doubled in size and capacity in the last 12 years, with some cars now using more wire and more electric light bulbs than the average home. As an example, the 1958 Buick uses nearly two miles of wiring in addition to which as many as 34 light bulbs and a dozen electric motors are used in some of their more luxurious '58 models.

EDITORIAL INDEX

Listing articles which have appeared in AUTOMOTIVE SERVICE DIGEST from March, 1957 through February, 1958

ACCESSORIES

	Month	Page
Installing ammeter	June	4
Starting car clocks	June	4
Lights to meters	June	28
Servicing heating systems	October	18

AIR CONDITIONING

Air conditioning—open field for service shops	May	38
Overcharging can cause clutch failure and belt slippage	January	36

AIR SUSPENSION

A look at air suspension	December	12
"Level air" compressor check valve relocated	February	57

ASSOCIATION MEETINGS

40th annual N.A.D.A. convention	March	21
Shows dramatize industry's aftermarket potential	April	32
A digest of automotive service	May	18
25,813 attend Southwest Show	May	61
Sell the job . . . or lose it!	August	22
Independent Garage Owners Convention	August	28
Top service personnel to attend N.A.D.A. Convention	December	70
Form "Automotive Refinish Institute"	February	16
The Pacific Automotive Show	February	48

AUTOMATIC TRANSMISSIONS

TorqueFlite won't reverse	May	69
PowerFlite fluid level	May	78
Burns out solenoids	July	8
Correcting PowerFlite "runaway"	August	57
Checking Turboglide fluid level on air conditioned models	August	78
Automatic transmissions—(First of a series)	September	18
When overhauling PowerFlite, examine clutch retainer bushing	September	78
Planetary gears (Automatic transmissions—Part II)	October	48
Hydraulic controls (Automatic transmissions—Part III)	November	40
Don't neglect TorqueFlite oil level	November	45
Dual range Hydra-Matic (Automatic transmissions—Part IV)	December	46
Always use new nuts	December	71
Check for leakage past input shaft seal rings	January	78
Servicing the Powerglide (Automatic transmissions—Part V)	February	18
Reversing check valve aids Torque-Flite action	February	61

AUTOMOBILE SHOWS

Chicago auto show celebrates its 50th year	December	9
50th golden jubilee Chicago auto show	December	16

AXLES

Rear axle bearing leaks	March	6
De Soto rear axle lube level	March	68
Chevrolet "Positraction" rear axle	April	70

BATTERIES

The dry-charged battery	April	33
More on 8-volt batteries	May	14
Junking batteries	July	4
Battery charge and discharge	September	77
A helpful tip on using battery fluid dispenser	February	76
Precautions to take when filling batteries	July	15
Servicing charging systems	September	12
Which car will stop first?	October	40
Which car will stop first?	January	8

BEARINGS

Still using too much oil?	April	46
Oil filtration—now more important than ever	May	48
Acid and friction—enemies of the internal combustion engine	September	28
Willys changes design of rear bearing oil seal	February	60

BODY RECONDITIONING

Pre-vacation check-ups	April	12
How to align sheet metal	June	12
"Futurize with 4-D styling"	June	44
Speeding up body repairs	June	56
Stopping seam leakage on convertible tops	July	31
Repairing sheet metal with plastic solder	July	36

BRAKES

Servicing vacuum-power brakes	March	32
Air in brake lines	April	4
Pre-vacation check-ups	April	12
Servicing air-hydraulic brakes	April	42
Raybestos develops liquid-cooled brake	May	30
Servicing straight air brakes	May	56
Pressure exerted on confined liquid	May	77
Air in brake lines	June	4
Squealing brakes	July	4
Correcting hard pedal on power brakes	July	51
Why H-D brake fluid	August	4
Lining trouble	September	8
Air in brake lines	October	12
New adjuster assembly eliminates squeaks	October	46
Quieting power brakes	October	76
Brake service—where quality is a must!	November	37
Tests show steady brake action more effective	February	77

CAMSHAFTS

Camshaft reclamation	August	50

CARBON

A report on firing chamber deposits	July	52

	Month	Page
CARBURETION		
Engine won't idle	March	10
Carburetor icing	March	37
Adjusting idle on Golden Hawk	March	37
Servicing fuel pumps	March	38
Caddy has rough idle	April	4
How does choke work?	April	8
Pre-vacation check-ups	April	12
Vapor lock—what's being done about it?	April	22
Engine stops now and then	May	10
Adjusting Oldsmobile's J-2 Rocket carburetors	May	32
Oldsmobile's J-2 Rocket carburetors	June	32
First aid for automatic chokes	June	36
Supercharger action	July	4
Curing carburetor-caused knocks	July	21
Carburetor adjusting hints	July	46
Unchokes too quickly	August	4
Man made fuels out-do nature's best	September	40
Rochester carburetor improvements	September	49
Adjusting carburetors	October	8
Who pours water in the gasoline tank	October	30
Design and function of rochester carburetor auxiliary throttle valve assembly	January	74
That all-important heat control valve	February	47
COOLING SYSTEM		
Change to a 6-blade fan?	March	6
1957 Dodge overheating?	March	37
Pre-vacation check-ups	April	12
Cooling system protection	April	18
Fan belts—do you check them regularly?	July	16
Air cooled cars	August	4
Sell complete winterizing now!	October	14
New fan prevents engine overheating	October	69
Trouble shooting the cooling system	November	30
Why radiators blow their top	December	30
Open *all* petcocks to drain cooling system	December	34
Blows its anti-freeze	January	8
CRANKCASE		
Still using too much oil?	April	46
Water in crankcase	July	4
Removing and replacing the '58 Windsor oil pan	February	74
CYLINDERS		
Installing De Soto head gasket	March	79
A report on firing chamber deposits	July	52
Preparing cylinders to receive piston rings	August	58
Acid and friction—enemies of the internal combustion engine	September	28
Combustion chamber turbulence	November	75
DIESEL		
Starting the big ones on cold mornings	January	34
DIFFERENTIALS		
Checking "non-slip" differentials	December	69
DISTRIBUTOR		
Properly lubricated distributor needed	July	42
Don't overlook the breaker plate	July	66
Primary and secondary ignition circuits	July	75
A shocking experience?	August	15
Distributor *maker* points	September	10
Breaker plate affects point opening and cam angle	October	46
Installing distributors	December	6
EDITOR'S PAGE		
Mechanics of the future—where from?	March	11
Classroom theory vs shop practice	April	11
A salute to our after-market manufacturers	May	17
Train them to keep them	June	11
Replacement market expanding, not shrinking	July	11
Selling and installing extra equipment pays off	August	11
Essentials to consider for operating a shop	September	11
New-car designs favor ease of accessibility	October	13
To sell them you have to tell them	November	11
Chicago auto show celebrates its 50th year	December	9
1958 general business outlook is good	January	11
We must look to our schools for help	February	13
ELECTRICAL		
1957 electrical service data	March	47
Ignition coil construction	March	71
Pre-vacation check-ups	April	12
The hidden resistance	April	26
The dry-charged battery	April	33
Hot engine hard to start	May	14
Condenser capacities	June	8
Testing coils and condensers	June	66
Diagnosing charging circuit troubles	July	31
Primary and secondary ignition circuits	July	75
The generator-regulator tester	July	48
Some fundamentals to help you when servicing magnetos	August	16
Reverse polarity damage	August	37
How and why fuses blow	August	57
High tension polarity	September	8
Servicing charging systems	September	12
Battery charge and discharge	September	77
Replacement wiring	October	8
Magneto current generation	October	75
TVRS cable—don't let it throw you!	October	52
Ohm's Law	January	75
ENGINE REBUILDING		
Installing a rebuilt engine	March	12
Still using too much oil?	April	46
Porting and relieving block and manifold	April	73
Meaning of crankshaft stroking	June	73
Marine engine service	July	38
More profits from valve service	August	44
Camshaft reclamation	August	50
Preparing cylinders to receive piston rings	August	58
Acid and friction—enemies of the internal combustion engine	September	28
Milling heads and blocks	November	34
Your reputation hangs by a thread	January	56
EQUIPMENT		
(See—Tools and Equipment)		
EXHAUST SYSTEM		
The exhaust analyzer—how it works	March	48
How to get better engine performance	April	54
Manifold heat valves—essential to efficient engine operation	April	57
Vapor from dual pipes	May	14
Heat valve operation	June	8
FILTERS		
Oil filtration—now more important than ever	May	48
Those new paper air filters	June	24
Air filtration—now more important than ever	July	18
Are dry type air filters effective?	December	32
FUEL		
Servicing fuel pumps	March	38
The exhaust analyzer—how it works	March	48
Vapor lock—what's being done about it?	April	22
Engine stops now and then	May	10
Improperly positioned filler tube vent air locks fuel tank when filling	May	60
Water in gas bowl?	July	4

	Month	Page
Where the gas dollar goes	July	8
Over 100 octane?	August	36
Man-made fuels out-do nature's best	September	40
Who pours water in the gasoline tank?	October	30
Starting the big ones on cold mornings	January	34

FUEL INJECTION

How to service the Rochester fuel injector	March	24
Why fuel injection?	June	30
Be careful when servicing fuel injection pumps	December	35
Interesting facts about fuel injection	February	76

GENERATORS

The hidden resistance	April	26
Six or twelve volt?	May	10
The generator-regulator tester	July	48
Servicing charging systems	September	12
Generator field current	September	57
Which car will stop first?	October	40
Polarizing generators	November	10
Stumped by generator	February	6

GLASS SERVICE

Installing glass?—here are some helpful hints	March	43
Replacing wrap-around windshields	November	46

HEADLIGHTS

Better lighting for safer driving	June	47
Aim to service . . . to sell . . . to live!	February	14

HEATERS

Servicing heating systems	October	18
Stopping leakage at heater blower housing	October	76

HORNS

New safety device "sees" horn of car behind	April	73

IGNITION

Reversing coil position aids cold starting	March	43
Ignition coil construction	March	71
Hard starting Cadillac	April	8
Pre-vacation check-ups	April	12
The hidden resistance	April	26
High tension polarity	May	14
Misses above 40 m.p.h.	June	4
Don't overlook the breaker plate	July	66
Primary and secondary ignition circuits	July	75
Setting Chevrolet V8 ignition timing	July	79
Curing Packard cross-firing	August	30
The Oscilloscope—how it works	August	70
The mighty mites of the ignition system	October	34
TVRS cable—don't let it throw you!	October	52
Plugs foul, points burn	November	8
Trouble shooting the ignition system	January	28
Oscilloscopes—seeing eyes of ignition	January	38

LIGHTING

Regulator setting too low	June	8
Better lighting for safer driving	June	47
Re-fusing lights that refuse to light	August	61
Aim to service . . . to sell . . . to live!	February	14

LUBRICATION

Pre-vacation check-ups	April	12
1957 Dodge V-8 lubrication chart	April	78
Removing anti-freeze from lubrication system	April	79
Additive oil	July	22
Effect of detergent oil	August	8
Acid and friction—enemies of the internal combustion engine	September	28
1957-58 Buick V-8 lubrication chart	December	78
Loss of oil pressure due to wrong gasket	February	71

MAGNETOS

Some fundamentals to help you when servicing magnetos	August	16
Magneto current generator	October	75

MARINE ENGINES

Marine engine service	July	38

MISCELLANEOUS

How to get better engine performance	April	54
A digest of automotive service	May	18
Specialized sealants	June	40
Back to school	June	52
"Phantom foot" for safer, easier car control	September	50
Make use of color in your shop	January	22
Locating cracks—the mechanic's invisible enemy	February	36
Make use of color in your shop	February	50

MUFFLERS

Short muffler life	April	8
Muffler blows, car stalls	October	8

NEW CARS AND TRUCKS

Ford trucks for '57	March	44
Jaguar's XK-SS	April	70
Edsel—starting from scratch	May	36
The Scotsman	July	42
The all-new Edsel makes its debut	September	24
Rambler for 1958	October	32
Chevrolet trucks for '58	October	54
Buick dealers to handle German-made Opel	October	77
Evaluating the 1958 models	November	12
Buick	November	14
Cadillac	"	15
Chevrolet	"	16
Chrysler	"	17
Continental	"	18
Corvette	"	18
De Soto	"	19
Dodge	"	20
Ford	"	20
Imperial	"	22
Lincoln	"	23
Mercury	"	23
Oldsmobile	"	24
Packard Hawk	"	25
Plymouth	"	26
Pontiac	"	27
Rambler	"	28
Studebaker	"	28
Edsel service highlights	December	26
Studebaker adds two new hardtops	January	16
Chrysler 300D	January	36
New Rambler American	January	54

PAINTING

"Futurize with 4-D styling"	June	44
Diversification helps shop profits	October	47
How to check spray gun efficiency	December	15

PARTS

Clear-Ex gives better engine performance	April	54
Fan belts—do you check them regularly?	July	16
Prolonging parts life with additive oil	July	22
Flat rate	July	32
Your reputation hangs by a thread	January	56
Locating cracks—the mechanic's invisible enemy	February	36

PISTONS AND RINGS

	Month	Page
Still using too much oil?	April	46
A real oil burner	May	10
Preparing cylinders to receive piston rings	August	58

RACING

Hanks wins "500"	June	42

RADIATORS

Cooling system protection	April	18
Checking radiator with vacuum gauge	July	46
Why radiators blow their top	December	30

RADIO SERVICE

Power output and the speaker	April	58
The RF circuit	June	70
Exploring the converter stage	July	76
Tracing signal and power output stages	September	74

REFRESHER COURSE

Ignition coil construction	March	71
Porting and relieving block and manifold	April	73
Pressure exerted on confined liquid	May	77
Meaning of crankshaft stroking	June	75
Primary and secondary ignition circuits	July	75
The Vernier micrometer	August	75
Battery charge and discharge	September	77
Magneto current generation	October	75
Combustion chamber turbulence	November	75
The meaning of inertia	December	71
Ohm's Law	January	75
Factors pertaining to the circle	February	75

SAFETY

A good shop is a safe shop	September	54
Sell customers on safety	October	45
To sell them you have to tell them	November	11
Aim to service . . . to sell . . . to live!	February	14

SCHOOLS

Classroom theory vs shop practice	April	11
Training Edsel mechanics	August	42
Up-grading mechanics	September	34
Diversification helps shop profits	October	47
We must look to our schools for help	February	13

SERVICE, SELLING

Roll out the red carpet—it pays off!	March	30
Sell the job . . . or lose it!	August	22
How's your salesmanship?	November	56
Look sharp . . . act sharp . . . be sharp!	December	42
Aim to service . . . to sell . . . to live!	February	14
Give it a "tune-up"	February	30

SHOCK ABSORBERS

Ride an even keel	August	38

SHOP LAYOUT

The importance of shop layout	December	36
Make use of color in your shop	January	22
Make use of color in your shop—Part II	February	50

SHOP MANAGEMENT

Roll out the red carpet—it pays off!	March	30
Strictly personal	March	37
Strictly personal	April	71
Tune-up can be good business in the small shop	June	18
Are you cashing in on one-stop service?	July	12
Flat rate	July	32
There's no profit in lost time	July	35
Service on the islands	August	12
Shop management	August	31
Essentials to consider for operating a shop	September	11
Up-grading mechanics	September	34
A good shop is a safe shop	September	54
Night service for trucks	October	26
Hiring new mechanics	October	56
How's your salesmanship?	November	56
Boosting production with incentive pay	November	60
Look sharp . . . act sharp . . . be sharp!	December	42
Finds it pays to "grow up"	December	77
Boost shop profits by cutting losses	January	44
Give it a "tune-up"	February	30

SPARK PLUGS

How to get better engine performance	April	54
Keep spark plug holes free of corrosion	May	61
The mighty mites of the ignition system	October	34
Your reputation hangs by a thread	January	56
Plugs not always to blame when engine misfires	January	59
Longer plugs needed on Dodge "L" series trucks	February	59

SPECIFICATIONS

1957 tune-up specifications	March	46

SPRINGS

Improving Plymouth ride	March	10
Checked those springs lately?	June	45
New type spring shackles improve Jeep ride	July	51

STARTERS

Six or twelve volt?	May	10
De Soto starter switch	June	35
When starter switch fails	November	29

STEERING SYSTEMS

Steering linkage	April	4
Overcoming shimmy on 4-wheel drive Jeep	September	23
Steering wheel alignment	November	59
Power steering no help	January	8

SUSPENSION

Ride an even keel	August	38
Ball joint replacement	October	76
A look at air suspension	December	12
Ball joint wear	January	8

TAX GUIDE AND BUSINESS BRIEFS

Tax saving now ready	March	58
What has gone before	April	41
Leased vs purchased equipment	May	46
Keeping up with your personal business	June	72
Figuring your depreciation	August	49
Suggestions for your business	September	46
Are illegal expenses tax deductible?	October	68
How to save on your 1957 taxes	November	70
End-of-the-year tax planning	December	58
Where to in 1958?	January	58
Expenses for travel and entertainment	February	58

TECH KNOW-HOW ARTICLES

How to service the Rochester fuel injector	March	24
Servicing vacuum power brakes	March	32
Servicing fuel pumps	March	38
Servicing air-hydraulic brakes	April	42
Adjusting Oldsmobile's J-2 Rocket carburetors	May	32

	Month	Page
Servicing straight air brakes	May	56
How to align sheet metal	June	12
Oldsmobile's J-2 Rocket carburetors	June	32
First aid for automatic chokes	June	36
More profits from valve service	August	44
Servicing charging systems	September	12
Automatic transmissions—a series	September	18
Servicing heating systems	October	18
Trouble shooting on the motor car	October	42
Planetary gears	October	48
Trouble shooting the cooling system	November	30
Hydraulic controls	November	40
Universal joint service	November	48
How to diagnose engine troubles	December	10
Dual-range Hydra-Matic	December	46
Trouble shooting the ignition system	January	2
Universal joint service	January	48
Servicing the Powerglide	February	18
Give it a "tune-up"	February	30
Servicing hydraulic valve lifters	February	40

THERMOSTATS

Cooling system protection	April	18

TIRES

Use care when installing 14" tires	April	31
Tires getting bad breaks	July	43
Tire thump—its cause and cure	September	26
Overinflation main cause of rough ride and tire wear	September	53
Nylon tire thump	October	51

TOOLS AND EQUIPMENT

Test equipment—how it works—		
The exhaust analyzer	March	48
The vacuum gauge and manometer	April	48
Compression and cylinder leak testers	May	52
Testing coils and condensers	June	66
The generator-regulator tester	July	48
The oscilloscope	August	70
Instrument combinations	September	68
How to increase shop profits with car wash service	May	42
Flat rate	July	32
How to use precision measuring tools	August	52
The Vernier micrometer	August	75
Trouble shooting on the motor car	October	42
How to diagnose engine troubles	December	10
How to care for electrical tools	December	52
The right tools on hand for the job	January	12
Oscilloscopes—seeing eyes of ignition	January	38
Locating cracks—the mechanic's invisible enemy	February	36
Make use of color in your shop	February	50

TRANSMISSION SERVICE

Rough overdrive	April	4
Overdrive won't downshift	April	4
Automatic transmissions	September	18
Dipstick readings vary	September	57
Planetary gears	October	48
Transmission noisy when decelerating	November	39
Hydraulic controls	November	40
Dual range Hydra-Matic	December	46
Correcting harsh shift on Corvette 4-speed transmission	February	16
Servicing the Powerglide	February	18

TROUBLE SHOOTING

Trouble shooting on the motor car	October	42
Trouble shooting the cooling system	November	30
How to diagnose engine troubles	December	10
Trouble shooting the ignition system	January	28

TUNE-UP

Profits from tune-up	March	28
1957 tune-up specifications	March	46
Pre-vacation check-ups	April	12
The vacuum gauge and manometer	April	48
Tune-up can be good business in the small shop	June	18
A report on firing chamber deposits	July	52
The oscilloscope	August	70
Sell complete winterizing services now!	October	14
Oscilloscopes—seeing eyes of ignition	January	38
Don't overlook valve lash	January	77
Give it a "tune-up"	February	30

TURBINE ENGINES

The gas turbine and free piston engine	April	34

UNIVERSAL JOINTS

Servicing universal joints	July	26
Universal joint service	November	48
Assembling U-joints	December	8
Universal joint service	January	48

VALVES

Still using too much oil?	April	46
How to get better engine performance	April	54
Valve grinding wheels	July	8
Installing distributor incorrectly causes noisy lifts	July	74
Exhaust valve failure	August	8
More profits from valve service	August	44
Noisy valve lifters	September	8
Sticking valves	September	10
Adjusting Willys valves	November	54
"Gallops" after overhaul	December	6
Valves get burned up, too!	December	18
Loss of valve adjustment	December	34
Valve grind job insurance	December	45
"Pops" on acceleration	January	71
Setting tappets cold	February	6
Loose valve seat inserts	February	6
Servicing hydrauiic valve lifters	February	40

VOLTAGE REGULATORS

The generator-regulator tester	July	48
Temperature influences on regulator settings	August	8
Servicing charging systems	September	12
Setting cut-out relay	November	8

WASHING

How to increase shop profits with car washing	May	42

WATER PUMPS

1957 Dodge overheating?	March	37
Leaking water pumps	February	39

WHEEL ALIGNMENT and BALANCING

Pre-vacation check-ups	April	12
Importance of wheel balancing	July	44
Tire thump—its cause and cure	September	26
Wheel balance by overbalance	November	53
Cash in on front end service	January	19

WINDSHIELDS

Installing glass? Here's some helpful hints	March	43
Replacing wrap-around windshields	November	46

WINTER SERVICE

Sell each and every customer complete winterizing services now!	October	14
Servicing heating systems	October	18
Starting the big ones on cold mornings	January	34

Grips the screw!
Drives it too!
Quick-Wedge
SCREW-HOLDING
SCREWDRIVER
2" to 14" blades. 4 bit sizes. Available with shockproof plastic covered tubing. Unconditionally guaranteed.
ASK FOR IT AT YOUR DEALER
Kedman Co., 233 S. 5th W., Salt Lake City

DRESS THOSE POINTS WITH
RIMAC Flex-Stone
The hardest abrasive obtainable, imbedded into a flexible plastic — that's Rimac FLEX-STONE! Can't cause a short circuit — gets to hard-to-get-at places — does its job in slots and corners. Available in standard, extra thin and fine.
ASK YOUR JOBBER OR WRITE FOR LITERATURE
RINCK-McILWAINE, INC.
16 HUDSON STREET · NEW YORK, N. Y.

Advertisers' index

The Advertisers' Index is published as a convenience and not as a part of the advertising contract. Every care is taken to index correctly. No allowance will be made for errors or failure to insert.

AC Spark Plug Division . . . . . *
Ames Company, B. C. . . . . *
Armstrong Hydraulics, Inc. 44

Barrett Equipment Co. 71
Bean Division, John Food Machinery & Chemical Corp. 7
Black & Decker Manufacturing Co. . . . . *
Blackhawk Manufacturing Co. . . . . *
Blitz Electric Co. . . . . *
Brake Parts Specialty . . . . . *
Breeze Corporation 10
Buick Motors Division . . . . . *

Champion Spark Plug Co. . . . . 8 and 9
Chevrolet Motor Division . . . . . *
Chicago Rawhide Mfg. Co. . . . . *
Chrysler Motor Parts Div. (MoPar) . . . 18 and 19
Clayton Manufacturing Co. . . . . *
Curran Corporation . . . . . *

Dana Corporation 60
Delco-Remy Division . . . . . *
Ditzler Color Division 72
DuMont Laboratories, Inc., Allen B. . . . . *

Eis Automotive Corp. 48
Electric Auto-Lite Co., The . . . . 2, 3, 26 and 27

Falls Products, Inc. . . . . *
Ford Motor Company . . . . . *
Fram Corporation . . . . . *
Frontier Manufacturing Co. . . . . *

General Motors Corporation . . . . . *
Graymills Corporation 56

Harvey E. Hanson Co. 73
Heyer Industries . . . . . *
Ernest Holmes Company . . . . . *
Houser Engineering & Mfg. Inc. 49

Ingersoll-Rand Company . . . . . 46 and 47
Inland Manufacturing Co. 75

Jack Pack Manufacturing Co. 69

Kal Equip Company 43
Kedman Company 83

Lake Auto Radiator Mfg. Co. . . . . *
Lee Company, K. O. 76
Lisle Corporation . . . . . *
Lucas Electrical Service . . . . . *

McQuay-Norris Mfg. Co. . . . . *
Milwaukee Electric Tool Corp. . . . . *
Mitchell Co., John E. 37

National Automotive Service . . . . . *
National Market Reports, Inc. . . . . 57 and 67

Owatonna Tool Co. 51

Perfect Circle Corp. . . . . Cover 2
Permatex Company, Inc. 1
Practical Manufacturing Co. 69
Proto Tools . . . . . *

Rajah Company 76
Ramsey Corporation . . . . . Cover 3
Rebuilders, Inc. . . . . *
Renberles Products . . . . . *
Rinck-McIlwaine, Inc. 83
Rust Master Chemical Corp. . . . . *

Snap-on Tools Corporation . . . . . Cover 4
Standard Motor Products 4

Thermobloc Div., Prat Daniel Corp. . . . . *
Trippe Manufacturing Co. 77
Tung-Sol Electric, Inc. . . . . *

United Motors Service . . . . . *

Wagner Electric Corp. . . . . *
Watson Co., H. S. . . . . *

Firms represented in this issue are indicated by page number. Advertisers in previous issues are indicated by the asterisk.

HE WHO LAUGHS, COME WHAT MAY,

WILL LIVE TO LAUGH ANOTHER DAY

Short circuit smiles

A large company decided to print the following on the salary receipt to eliminate some trouble they had been having.

"Your salary is your personal affair—do not discuss it with your friends."

When the paymaster was checking through them he found that one employee had written, "Don't worry, I won't. I'm as ashamed of it as you are."

★ ★ ★

A motorist stopped to talk with a farmer erecting a small building near the road. "What're you building?" he asked.

"Wal, I tell ya," said the farmer, "if'n I can rent it after it's up, it's a rustic cottage, but if'n I can't, it's a cow shed."

★ ★ ★

The commissar presiding over the court glared down at the first defendant. "What is the charge?" he growled to the prosecutor. "His factory showed a profit." "Five years for exploiting the masses! Now, what is this next man's crime?" "His factory showed a loss." "Ten years for robbing the state!" the commissar thundered. "And the next?" "His factory broke even." The commissar pondered a moment. Then his face brightened. "Fifteen years for delaying the course of Soviet justice!"

★ ★ ★

The preacher was finishing admonishing his flock of the evils of avarice. "And remember, my friends," he said, "There will be no buying or selling in Heaven."

Whereupon a man who sat in the back seat was heard to grumble, "That's not where business has gone, anyway!"

★ ★ ★

It was hot and dry as the two camels trudged wearily along side-by-side in a caravan on the burning desert. Finally one camel looked around furtively and whispered to his companion, "I don't care what people say . . . I'm thirsty!"

A New York psychiatrist met his old friend, Sam, and asked him how things were going.

"Not so good," was the pained reply. "My brother is very sick."

"Your brother isn't sick," contradicted the psychiatrist, "he only thinks he's sick. Remember that, he only thinks he's sick."

Two months later they met again. "How's your brother now," asked the psychiatrist.

"Worse," groaned Sam. "He thinks he's dead."

★ ★ ★

A local small fry had been vaccinated and after the operation the doctor prepared to bandage the sore arm, but the boy objected.

"Put it on the other arm, doctor."

"Why, no," said the physician, "I want to put the bandage on your sore arms so the boys at school won't hit it."

"Put it on the other arm, Doc," repeated the boy. "You don't know the fellows at our school."

"I suggest you either change your name or go into a new business!"

The doctor was having a polite but firm argument with a patient over the amount of a bill.

"You must remember, Mr. Drew," said the doctor, "you were in pretty bad shape and I fixed you up. You wouldn't question an auto mechanic who got your car running again, would you?"

"That has nothing to do with this case," insisted Mr. Drew. "If I had a car that was in the condition I was in, I'd trade it for a new one."

★ ★ ★

The city slicker halted his car at a desolate crossroad and yelled to a farmer driving a load of hay, "Hey, Cornsilk, is this the way to town?"

The farmer looked up in feigned astonishment. "By gum, stranger, how'd you know my name was Cornsilk?"

"I guessed it," answered the slicker.

"Then, by heck," snapped the farmer, "guess your way to town, too!"

★ ★ ★

A canny Maine farmer, who made it a rule to think before speaking, was approached by a stranger one day and asked, "How much is that prize Jersey heifer of yours worth?"

The farmer thought a moment, then asked, "Are you a tax assessor, or has she been killed by a train?"

★ ★ ★

A would-be soap-box orator who had reached the argumentative stage sat down next to a clergyman on a bus. Wishing to get into an argument, he turned and said, "I'm not going to heaven because there is no heaven."

His words, however, got no response.

"I said I'm not going to heaven because there is no heaven," he said again, almost shouting as he came to the end of his sentence.

"Well then," replied the clergyman calmly, "go to hell, but be quiet about it."

★ ★ ★

Mother: "Daughter, didn't I tell you not to let that strange man come over to your apartment last night? You know it's things like that that cause me to worry."

Daughter: "Don't be ridiculous, mother. I went over to his apartment. Now let his mother worry."

★ ★ ★

Trying to sell a housewife a home freezer, a salesman pointed out, "You can save enough on your food bills to pay for it."

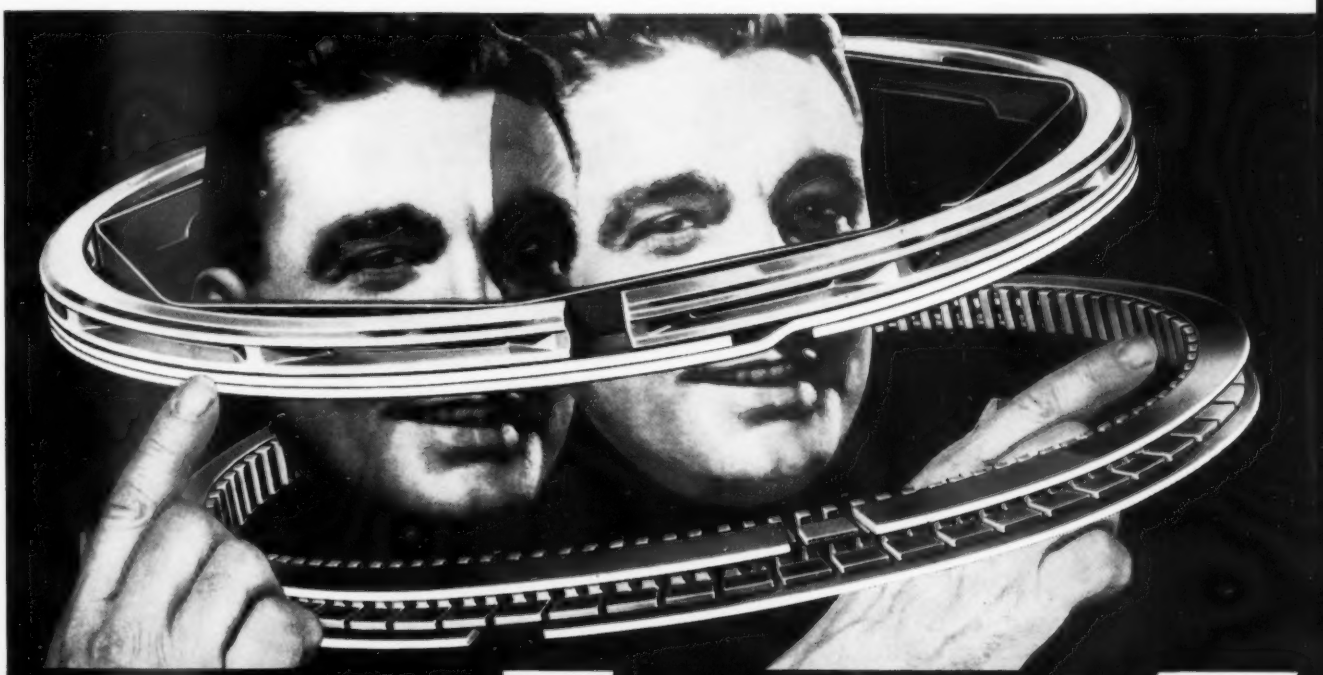
"Yes, I know," the woman agreed, "but you see we're paying for our car on the carfare we're saving. Then, we're paying for our washing machine on the laundry bills we save, and we're paying for the house on the rent we're saving. We just can't afford to save anymore money right now."

★ ★ ★

Says a local cynic: "The only reason a great many families don't own an elephant is that they never have been offered an elephant for $1 down and $1 a week."

Only RAMCO gives me 2 CIRCUMFERENTIAL EXPANSION* Oil Rings to make me DOUBLE SURE

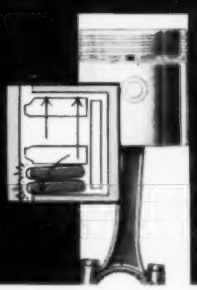
my ring jobs are "CUSTOMER PERFECT"



*

CHROME SPIRO-SEAL OIL RINGS

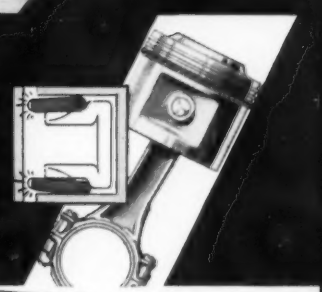
The RAMCO Spiro-Seal Segment utilizes an exclusive, years-ahead *circumferential expansion principle* which insures high conformability to cylinder walls. It works like a watch spring to adjust to taper or wear. Riding *independently of piston groove depth*, it provides equalized radial pressure against cylinder wall for positive oil control.



*

CHROME C-9 OIL RINGS

Here is the most advanced expression of the *circumferential expansion principle*. This newest advancement in ring design assures a new high in conformability. With an average of 60 outward thrusts, it adapts easily to cylinder variations and variable operating conditions, in both stop and go and high speed operations.



for OLD engines or NEW... RAMCO 10-Up SETS restore new car power, positive oil control

Not one — but TWO *circumferential expansion* oil rings! That means every engine you re-power with RAMCO can have the benefit of this important advancement in ring design!

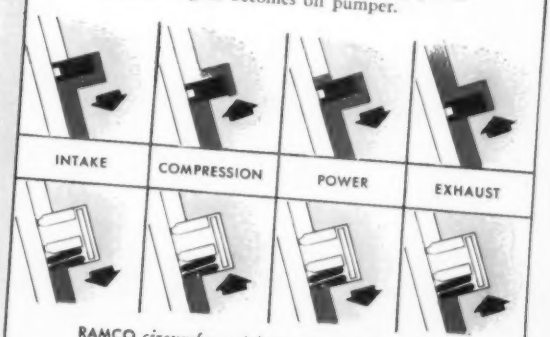
In every RAMCO 10-Up Set you're sure to find either Chrome Spiro-Seal or Chrome C-9 oil rings. Both have *circumferential expansion action* for high cylinder conformability. Both are designed to re-power specific engines — old or new.

Both are RAMCO-engineered for positive, side-sealing oil control, too. Both insure you against oil pumping, blow-by, compression loss.

That's why you're DOUBLE SURE to re-power right when your work sheet calls for RAMCO 10-Up Sets! See your RAMCO Jobber today!

SEE HOW RAMCO CIRCUMFERENTIAL EXPANSION OIL RINGS INSURE POSITIVE, SIDE-SEALING OIL CONTROL!

CONVENTIONAL RINGS: Note how oil works into ring land on power and exhaust strokes — is burned with fuel on succeeding power strokes. Engine becomes oil pumper.



RAMCO *circumferential expansion* oil rings — utilize a side sealing principle as illustrated here by the Spiro-Seal action in the Chrome Spiro-Seal Oil Ring to positively seal against "oil creep" on *all* strokes.

RAMCO 10 up PISTON RING SETS

RAMSEY CORPORATION, St. Louis 8, Mo.
a subsidiary of Thompson Products, Inc.

Copyright 1958, Ramsey Corporation R-238

Wheel Alignment jobs up 45 percent in past 7 years

Cash in on this profit-maker with a Snap-on Wheel Alignment Set

Wheel aligning pays big dividends to shops with the necessary equipment. According to industry sources, wheel aligning jobs have increased 45 percent in the past seven years to a total of 15,647,000 at the present time.

Stop passing aligning profits on to other shops. With *Snap-on's* easy payment plan, you can get your own *Snap-on* wheel alignment equipment — pay for it out of profits.

This equipment does not tie up valuable floor space, and is so simple to use any mechanic can quickly become an expert. The set provides gauges and tools for checking and adjusting camber, kingpin angle, toe-in, turning radius.

It's profitable. Use it on any level spot in the shop. Just paint positioning marks for turntables. Between jobs, space is available for other work.

It's simple. Anyone can easily read the precision-etched vials in the magnetic gauge and the clearly marked degrees on the turntable. No complicated computations are necessary.

It's accurate. You can get complete accuracy because the magnetic gauges are held to the exact center of the only machined surface of the wheel.

Step up profits now with your own wheel alignment set. Ask your *Snap-on* man for full details about this equipment and the *Snap-on* easy payment plan.

Only $40.40 down and $8.28
per week puts this *Snap-on*
Wheel Alignment Set 2033-WA-S
to work for you.

Prices subject to change without notice.

SNAP-ON TOOLS
CORPORATION
8018-C 28th Avenue • Kenosha, Wisconsin